THE

ELECTRICAL REVIEW.

VOL. LV. NOVEMBER 11, 1904. No. 1,407.

ELECTRICAL REVIEW.

Vol. LV.] CONTENTS: November 11, 1904. [No. 1,407.

	Page
The Commercial Side of Engineering	769
Municipal Telephones	770
Tramway Schemes and Local Veto	770
The Association of Tramway and Light Railway Officials.—Wakefield Meeting	771
Electro-Chemistry at the St. Louis Exposition (*illus.*) ...	773
The Passivity of Metals	774
Legal	775
Correspondence	776
Business Notes	778
The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board's Scheme (*illus.*)	786
Electricity Supply Accounts	796
City Notes...	797
Stocks and Shares	798
Share List of Electrical Companies	799
Market Quotations	800
Electric Tramway and Railway Traffic Returns	800
Reviews	801
The Fifth International Electrical Congress (*concluded*) ...	802
The Faraday Society	803
Visit of the Institution of Electrical Engineers to America (*continued*)	804
Simple Stories	805
Enamelled Wire for Heaters and Resistances	806
Dual Commissions	806
New Ozoniser (*illus.*)	807
New Patents Applied For	808
Patents Expiring during 1904	808

THE

UNIVERSAL ELECTRICAL DIRECTORY

1905 Edition

NOW IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone No. 933 Holborn; 4425 Central.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades,
AND HAS
BY FAR THE LARGEST CIRCULATION
of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free, per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE COMMERCIAL SIDE OF ENGINEERING.

THERE has been a good deal of agitation during the last few years as to the necessity of strengthening the technical education available to those entering our industries, and the increasing difficulty experienced by this country in competing with manufacturers from abroad, has been ascribed largely to the superior technical education which is afforded to those who are competing against us.

Great as may be the truth in this contention, there is another side of the question which is largely ignored, and which deserves at all events more attention than it receives, and that is, the commercial side of engineering. Comparatively little thought is given to this subject by many of our manufacturing concerns—at all events in comparison with the attention which it receives in America and Germany—and it is, in the opinion of many qualified to judge, in this direction very largely that British manufacturers as a body, are backward and out of date.

Without going outside the electrical industry for examples, it is easy to find instances of manufacturers, long established and pioneers of the industry 10 and 15 years ago, who have given up their leading position to newcomers during recent years. It would scarcely be exaggerating to say that this has been the fate with the majority of our older firms, for reasons not apparent at first sight. Is it not true that the products of their shops, at all events in most cases, still compete in excellence and in price with the best? Why is it then that new firms have been able to establish themselves in our midst, and to occupy the leading positions among manufacturers, whilst those already established, have been unable even to hold their own?

The answer would seem to be that a distinctive feature in the organisation of modern firms is lacking in that of the older ones, and that this distinctive feature, reduced to a few words, consists in placing *business* before *engineering*.

Analyse the constitution of any of those companies whom one can qualify as successful, whilst working a competitive business, and it will be found that the commercial element predominates, and that the technical element whilst all-powerful in its own channels, does not figure in everyday business transactions between contractor and client.

On the other hand, analyse the lines on which many businesses are still managed (though it is every day of less use looking for them in the front rank), and it will be found that the technical element is at a premium, whilst the commercial element—or what there exists of it—is at a discount. The situation is analogous to the position of a mathematical scholar, who finds himself accidentally placed on the classical side, where little sympathy or scope presents itself for his exertions, and where his surroundings seem foreign and strange. And yet it would be difficult to argue that the one is more or less

important than the other; both have their spheres of usefulness, and only circumstances can dictate which shall come first.

In making these few remarks, it must be remembered that the commercial staff of modern engineering firms—outside those departments which are commercial pure and simple, such as the secretarial and accounting departments—is made up of those whose training has been of a technical nature, and who would be unable to carry on their commercial work but for their engineering qualifications

In other words, modern conditions have brought into existence a new class of engineer—styled the commercial engineer—whose existence is justified on commercial results, and whose operations, whilst commercial first, are based on a solid foundation of technical and practical training.

To anyone who has been watching the progress of events during recent years, examples of the increasing influence of commercial over technical ability in our industrial concerns are scarcely necessary, though several might be given as good illustrations.

It has not been the intention in these few remarks to belittle the technical side of our industry—far from it. On the contrary, those responsible for the design and execution of our manufactures deserve encouragement in every possible way if this country is to maintain its position among the manufacturing countries of the world.

It is, however, only by attaching them to a strong commercial organisation that their strength and welfare can be advanced, as little is the value nowadays of any manufacturing concern which can manufacture only, and knows not how to dispose of its manufactures.

It is comparatively safe to say that the chief fault in the organisations of most of our industrial concerns lies in the fact that engineering comes before business, and that the latter has in many cases only been added as an after-thought.

Those that survive these days of over-production will have to be organised on different lines, and the change will have to come among those responsible for the policy, namely, from the top.

MUNICIPAL TELEPHONES.

Municipal authorities are always interesting when discussing telephone questions, and never more so than when their discussion is with the Postmaster-General. A deputation of representatives of those corporations owning and working telephones waited upon the Postmaster-General on Monday afternoon last. The Lord Provost of Glasgow explained that such corporations were in a state of considerable anxiety and doubt as to the future, and this anxiety tended in some measure to restrict their efforts. If the National Co.'s system were bought at all, the representatives thought the whole system ought to be purchased, and a solution of the problem which he suggested was the granting of a lease for a certain period of years to the great municipalities which had a service working in concert with the Government. It is, perhaps, due to a brief report that there is a certain lack of clearness in the propositions put forward, but we presume that the Lord Provost of Glasgow desired that dual systems should continue in those localities already blessed with them. The Brighton representative thought it would be impossible to make it compulsory on municipal authorities throughout the kingdom to take over the telephone system. We presume that this remark has reference to the proposal which is by no means novel that the local authorities should conduct the local services and the Post Office restrict itself to the trunk lines. The Postmaster-General, as is usual when these deputations take place, had an opportunity of giving the representatives something to think about. If the municipalities were to pick and choose, the effect would be that the profitable districts would be worked by the municipal authority and the unprofitable districts would be left to the Government. He expressed his gratification that the deputation were agreed that, if the National Telephone Co.'s business were purchased, it should not be done piecemeal, but as a whole. He further stated that he could not see that the transfer of any portion of this business to municipalities would conduce to cheapness or to efficiency. The *Times* report of the proceedings concludes with the statement that "the deputation afterwards consulted with the Postmaster-General in private." If Lord Stanley took advantage of the greater privacy to make any communications of greater frankness, we hope that they will not be lost on the municipal representatives.

TRAMWAY SCHEMES AND LOCAL VETO.

The possession of an absolute veto on the construction of electric tramways through their districts, which is one of the cherished privileges of municipal authorities, is not without certain drawbacks, which may convert it into a sort of boomerang that recoils upon the head of the user. In the case of electricity supply undertakings, the Board of Trade is empowered, if it sees fit, to dispense with the consent of local authorities; but this is a power which it has very rarely exercised, and in the case of traction it is altogether wanting, for there is no appeal even to the Board of Trade against the veto of the local authority. It is impossible even to go to Parliament for powers, for the Standing Orders cannot be complied with unless the consent of the authorities concerned, or most of them, has been obtained.

It has been suggested that the local authority knows better than Parliament whether a tramway would be good for its area or not—a view with which we cannot agree. Local authorities are too prone to harbour parochial ideas on such questions, instead of adopting broad views and taking into due consideration the welfare of the whole population of a county or district. Moreover, it is notorious that the local veto is often used purely for extorting money from the promoters of electric tramways; last year, for example, before the London Traffic Commission, Mr. W. H. Dickinson, chairman of the Special Committee of the L.C.C. on Locomotion, and therefore an authority on the manners and morals of municipal authorities, put forward this statement, and said it was a common thing for local authorities to see how much they could squeeze out of the tramway companies.

That private enterprise should be thus hampered by the ignorance and rapacity of Bumbledom is bad enough; but what are we to say when the London County Council, the crowning glory of the cult, is humiliated and embarrassed in the execution of its vast schemes for the amelioration of the condition of the working classes, the catching of votes, &c., by the uncompromising veto of the Metropolitan Borough Councils? For several years past certain of the latter have obstinately refused to permit the adoption of the overhead trolley system in their salubrious and picturesque thoroughfares, and thereby have not only denied the luxury of cheap and rapid transit to their constituents, but what is worse, have prevented the adjoining boroughs from sharing in that privilege. The loss and inconvenience occasioned by this ridiculous attitude can hardly be realised. Not only are large and densely populated areas, especially in North London, deprived of the transit facilities which they have a right to enjoy, both towards the City, and towards the open country, but large sums which would accrue to the county, were the electric cars in use, are foregone. Moreover, the surrounding electric tramway authorities on the north and west are deprived of the through communications which would be so beneficial both to themselves and to their passengers, and London, the greatest city in the world, lags behind every other capital of the first rank, to say nothing of countless towns of less importance.

But to what cause is the trouble due? To no other than the action of the County Council itself, in advocating the underground conduit years ago as the *only* possible system for so great a city as London, in face of the great majority of engineers and experts. And so awkward is the position in which the Council has landed itself, that it can now find no remedy save the drastic one of an appeal to Parliament, to remove the veto of the local councils! If this be done, then let the veto of local authorities in general be abolished, as was recommended by Lord Cross's Committee in 1898. Incalculable harm and injustice have been wrought by its exercise in the past; it is high time that reforms were effected, not only in this direction, but also in many other phases of tramway enterprise.

The Birthday Honours.

It is with great satisfaction that we are able to offer our hearty congratulations to Dr. J. Wilson Swan, F.R.S, on the honour—well-merited but much-belated—which has been conferred upon him this week by His Majesty the King. Dr. Swan's work of well-nigh a quarter of a century ago in connection with the incandescent electric lamp has made his name a household word for a long time past, but it is only at the eventide of his life that the national recognition, which some of us have more than once advocated, has been granted to him. May Sir J. W. Swan be spared yet many honoured years to further aid in the perfecting of the electric lamp, and to engage in electro-chemical and other scientific research.

Another name in the list of Birthday Honours is that of the Hon. C. A. Parsons, D.Sc., F.R.S., whose pioneering work in the domain of prime movers has been crowned with such great success during the last few years. Mr. Parsons has our congratulations upon his appointment to be a Companion of the Most Honourable Order of the Bath (Civil Division). Mr. J. A. Bellamy, of Plymouth, who, in addition to valued service in connection with technical schools, played an important part in the promotion of electrical communication between lighthouses and the shore is among the new Knights. There is one name more in the list which should be singled out for reference, namely, that of the Astronomer Royal, Wm. H. M. Christie, Esq., C.B., F.R.S., who is promoted to be a Knight Commander of the Order of the Bath.

THE ASSOCIATION OF TRAMWAY AND LIGHT RAILWAY OFFICIALS.—WAKEFIELD MEETING.

In our last issue we referred briefly to the opening of the above meeting at the Town Hall, Wakefield, on the 2nd inst. The two days' proceedings were of a very successful and enjoyable character. Not the least pleasant function was the dinner, held in the Banqueting Hall of the above building, to which the members of the Association and friends were invited by the chairman and directors of the local Light Railway Co., and at which a somewhat lengthy toast list, interspersed by local musical talent, contributed to quickly pass the evening hours.

At the termination of the dinner, the Light Railway Co., in the person of Mr. Harry England, the President of the Association and general manager, was again to the fore, a special car being placed at the disposal of those visitors who returned to Leeds, and on the morning of the 3rd inst., a similar provision was made, when many members and friends enjoyed the cross country run to Wakefield in the keen morning air.

The second day's business included papers by Mr. F. Coutts, of Ayr, on "Systems of Ticket Checking," and by Mr. Alfred Raworth on "Mr. Raworth's System of Regenerative Control." The former paper elicited many interesting expressions of opinion from the tramway officials present, and the discussion on the latter, owing to its subject being somewhat little known to the majority of those in attendance, resolved itself, with one or two exceptions, into questions and answers.

In the afternoon the formal opening of the Wakefield and District Light Railways took place, and the members were afforded the opportunity of paying visits to the Corporation electricity station, Messrs. Green's economiser works, and the Light Railway Co.'s power station and car-shed at Belle Isle and their Wakefield sub-station. The ceremony drew a numerous attendance of the members of local Councils interested in the Light Railway undertaking, and much interest was taken in the proceedings.

The Wakefield and District Light Railway scheme covers an extensive district, involving, when completed, the construction of some 75 miles of single-track. The routes at present laid down embrace some 30 miles of single-track, and link together Leeds (Thwaite Gate), Wakefield, Sandal Magna, Agbriff, Ossett, Rothwell and Oulton.

The gauge is standard, viz., 4 ft. 8½ in., and it is satisfactory to note that through running to the centre of Leeds is already in operation, by arrangement with the Corporation of that city.

The equipment includes a power station, sub-stations at Wakefield and Rothwell (there will eventually be two others, at Castleford and Ossett respectively) and three car-sheds, at Wakefield, Rothwell and Castleford respectively. The main generating station and car-sheds are situated at Belle Isle, on the south side of Wakefield, and on the banks of the River Calder. The former contains a three-phase H.T. equipment working at 6,300 volts pressure and 25 cycles, energy being transmitted to the sub-stations, where it is converted to D.C. at 500—550 volts for use on the line.

At the generating station, the boiler house plant consists of four Lancashire boilers, fitted with mechanical stokers and induced draught by means of steam jets. Hall feed pumps, a small direct current set for operating the station motors, and a "Green's" economiser are also provided.

The generating plant consists of three "Howden" high speed triple-expansion engines, running at 375 r.p.m., and direct coupled to Dick-Kerr 400-KW. alternators, having the exciter mounted on an extension of the alternator shaft.

Ejector condensers are fitted to each generating unit, the condensing water being pumped from the river by means of three motor-driven centrifugal pumps.

The H.T. switchgear is of simple construction, the power station switchboard consisting of three generator, one power and three H.T. feeder panels.

The sub-stations are fed through duplicate three-core H.T. lead-covered cables, the sub-station equipment consisting of standard Dick, Kerr 200-KW. rotaries fed through oil cooled

step-down transformers on each phase. A small induction motor is provided for starting up the larger units.

The rolling stock will include 55 double-deck single-truck cars, each fitted with a complete Dick, Kerr standard equipment. The contractors for the whole of the work were Messrs. Dick, Kerr & Co., Ltd.

The following is an abstract of the paper on "Average Speeds and Speed Allowances," by Mr. A. R. Fearnley, Sheffield :—

It will be remembered that in the early part of 1903, as a result of a conference which was held between the Board of Trade and tramway representatives, a number of statistics were obtained from Continental and American tramways on the question of "average speed." Up to this time the maximum speed allowed on the British tramways appears to have been in a few cases 10 miles an hour, and in the majority of instances only 8; and, further, Continental tramways were in many instances running considerably higher speeds, especially on routes which were described as "purely suburban."

In consequence of the meeting with this deputation, and the information which was subsequently obtained and submitted to the Board of Trade, it was announced that the Board of Trade officials would be sent round, when requested, to re-inspect any routes on which it was thought a higher speed should be allowed, and would again report upon the matter to the Board.

The present paper shows the results of this offer, as embodied in replies received from 81 British tramways to whom inquiries were addressed. According to these replies, the highest speed now allowed on any British tramways is 15 miles an hour, including the Leeds Corporation tramways, the Dublin and Lucan, and Hartlepool tramways. Fourteen miles an hour was granted to Barrow-in-Furness, Birkenhead, Cardiff, Glasgow, Hull, Lanarkshire, Liverpool, Manchester, Walsall and Newcastle-on-Tyne; and in eight of these 10 towns this maximum of 14 miles an hour has been granted under the direct representation or request of the management. Twelve miles an hour now appears to be the average maximum speed allowed, and some 37 tramways have obtained this allowance, amongst these being my own department—viz., Sheffield—also Salford, Blackburn, and the London County Council, in addition to many other important undertakings.

There are 25 tramways which are still only allowed 10 miles an hour as a maximum, and one is at a loss to understand this in such places as Chester, Blackpool, Doncaster, Farnworth, Southport (both company and municipal), and South Staffordshire. The tramways of Burton-on-Trent appear to stand alone as regards speed, and whether this is a peculiarity caused by the numerous level crossings connected with the breweries in that town, or from some other reason, I am unable to say; but the maximum speed allowed at Burton-on-Trent is 9 miles an hour.

Eight miles an hour is still the maximum on six tramways—viz., Chatham, Dover, Oldham (Ashton and Hyde), Wigan, Wrexham and Middleton.

In regard to "average speeds," leaving out of the question light railway undertakings, I find some 14 tramways who state that they are obtaining an average speed of from 8 to 8¼ miles an hour. These are:—Blackpool, Chester, Darwen, Doncaster, Gateshead, Gravesend, Grimsby, Lowestoft, Newport, Oldham, (Ashton and Hyde), Poole, Warrington, Worcester, and another large tramway undertaking.

It is interesting to note that in this list of 14 just read, there is not included a single tramway which has been granted the maximum allowance of 14 to 15 miles an hour mentioned in the earlier part of this paper, and, further, that only half of those named, *i.e.*, seven, have even 12 miles an hour allowed as a maximum, so that on many of these roads, where 8 to 8¼ miles is being obtained as an average speed, the maximum allowance is 10 miles an hour.

Four towns returned 7⅞ to 8 miles an hour as their average; ten towns 7½ to 7⅞ miles, among which are such busy tramways as Liverpool and Birmingham; ten returned 7 to 7½ miles, among which we find Manchester and Glasgow; three returned 6¾ to 7 miles as their average, included in the three being Newcastle and Hull; twelve returned 6½ to 6¾ miles an hour, included in which are Huddersfield and Halifax (both towns with very steep gradients), and also Wolverhampton with a system of traction peculiar to itself; ten returned 6¼ to 6½ miles, and included in this list is Leeds, with its maximum speed of 15 miles; ten returned 6 to 6¼ miles; three returned 5⅞ to 6 miles amongst which I find Sheffield; two returned 5½ to 5¾ miles, viz, Norwich and Chatham; and two returned 5¼ to 5½ miles, viz, Ipswich and Wigan.

The average of the average speeds of the 81 tramways is 7·24 miles an hour, which is fairly satisfactory. There is no doubt that the average is considerably lowered in many towns by the great amount of time that cars are allowed to stand idle at the termini. Whilst this standing over time at the terminus has certain advantages, I think it will be found that it pays very much better to keep the cars moving and allow only just sufficient time at a terminus to reverse, &c.

It can be at once seem from the tabulated returns which have been received in connection with this question, that a very considerable advance has been made during the past three years regarding the question of speed allowed. Up to 1901 the majority of tramways were only allowed a speed of 8 miles an hour, and this appears to have been a standard maximum speed with the Board of Trade since the late seventies or early eighties.

It is a very nice point at the present time to decide whether the speed on Continental tramways is in excess of the speed on British tramways; and if the roads which are described as "purely suburban" are left out of the question, the English tramways are at least equal to the Continental tramways, the average of the Continental tramways being returned at 7·2 and our own at 7·24.

The American return published in 1903 stated that their average speed on urban routes which pass through the centre of the city from one extremity to the opposite extremity, was 8·13 miles an hour, and as many of our own routes comply with this condition, it will be seen that we are gradually approaching American ideas of tramway speed.

There is no doubt that the public are gradually becoming accustomed to higher speed, and the Motor Car Act passed last year, by allowing a high maximum rate to motor cars, has done a good deal to remove prejudice and opposition to quick running.

Is there any good reason why the samemaximum speed which has been granted to motor cars should not also be granted to the tramways, for those portions of their routes where it may be run with safety? The conditions which might be required are:—An urban route. Track to be kept in first-class condition and to be either double track or long lengths of single track without crossings, &c. Cars to be fitted with power brakes which are to be used as service brakes, and gradients not to exceed 1 in 20; these conditions, I believe, are to be met with on many electric tramway systems at the present time.

In America I notice that tramcars are now making through runs of over 90 miles, and attaining a speed of 30 miles per hour, but unless higher speeds are allowed in this country, one fails to see how many of the existing and suggested suburban tramways and light railways are to be worked successfully. It is useless to expect that tramways working between towns 12 or 14 miles apart will attract much through traffic, if to complete such a short journey it takes, say, 80 minutes; and it seems to me that under such conditions the through traffic will only be obtained in the very fine weather by the medium of pleasure seekers, or by very considerable reductions being made in the fares compared to those charged by the railway companies, who are generally competitors with tramways of this description.

If higher speeds are to be allowed and taken advantage of, I am strongly of the opinion that some very decided change will have to be made in our methods of constructing tramway tracks. To attempt to run at the speeds reported as being allowed and attained on American tramways, on tracks laid as at present in this country, on what may be termed the "solid system," I am convinced would soon lead to serious trouble, and I have wondered whether the advocates of goods traffic on tramways have considered the matter from this point of view.

The discussion drew forth many expressions of opinion as to the influences which tend to reduce tramway speed, it being conceded that the intricate junctions and heavy traffic in the larger systems was one cause, and among others were, frequently, prejudiced local authorities.

It was pointed out that the factor of public safety is fully safeguarded, as accident risks cannot be entertained by the undertakers on financial grounds, and this should be understood by the B. of T. when considering requests for increased speed allowances.

A member gave it as his opinion that the maximum speeds (*i.e.*, Board of Trade allowance) should be at least double the average, to make up for stoppages. From records taken in ordinary running, it was found that on a 14-mile route the average speed was 7½ miles per hour, while the maximums were 13½ to 14½ miles per hour. Other runs gave averages of 7·6 miles, 7·4 miles, and 9 miles, with maximums of 17 miles, 17·5 miles, and 16 miles respectively. On the 14-mile run there were 72 stops, each averaging 9 seconds, and the time for the whole run was 1¾ hours.

Mr. A. N. Banister, of Norwich, contributed a paper on "Cost and Maintenance of Tramway Car Wheels and Rails," in which the author discussed the pros and cons of steel tires *v.* chilled iron wheels, illustrating many features in connection with the Norwich tramways by means of diagrams.

His experience with some experimental sets of steel tires was a great improvement on the average chilled wheel, the life in the two cases being 48,000 and 14,000 miles respectively—the prices of the steel tired wheels were now reduced some 25 per cent., and they showed a saving over the chilled wheels of 6·6d. per 1,000 mls.

The author proceeded to detail many points of interest in relation to track and car maintenance, which factor had the greatest bearing on their life. Among other items the author advocated very easy curves on points; a considerable slackness of gauge at curves in order to take the wear on the check; and the grinding of wheels when as much as $\frac{1}{16}$ in. difference of diameter appeared in a pair. The average life of his chilled wheels had risen to 19,000 miles, due only to care in running and track maintenance.

He had had a curious experience with wood paving laid inside the track only; this had swollen to such an extent as to cause the rails to take a wave form, causing many broken wheel flanges.

He considered that corrugation of rails was produced by high speed, and this had occurred at different times on both up and down grades, and also on both straight and curved track. His practice was to grind them out by running cars over the place at night, the cars having carborundum blocks fitted on to the track brakes. From observations, he judged that the rails at Norwich would last about 16 years.

Mr. Banister also added that 45 per cent. of his cars were fitted with steel-tired wheels, which, however, didn't promise to be as good as the experimental ones, although at present the steel wheel had the advantage. His track was constructed to a 3 ft. 6 in. gauge, and the smallest radius was 30 ft., the wheel base of his cars being 6 ft.

The adoption of steel tires had necessitated many alterations, owing to the increased wheel diameter.

The discussion produced opinions generally favourable to the steel-tired wheel. Several speakers declared that wheel flats and brake troubles disappeared with their adoption, and one member referred to 13 years' satisfactory experience of their use; he had reached as much as 80,000 miles with a steel tire ($3\frac{1}{2}$ in. thick), and reckoned 5,000 miles running for $\frac{1}{4}$ in. reduction in diameter, due to wear. Another speaker had nearly doubled his car-wheel mileage at the same cost, by using steel tires on wrought-iron centres in place of chilled cast-iron wheels.

Mention was made of steel tires wearing in steps on one system, it being attributed to running over two tracks of different construction. The maker's guarantee of 55,000 miles with steel tires was referred to as having been exceeded, and average lives of 21,000 miles and 56,000 miles respectively, for chilled and steel-tired wheels respectively, were given in the case of one undertaking employing many cars equipped with both classes of wheel.

The following is a brief abstract of the paper read by Mr. F. Coutts, Ayr, entitled "Is Our Present System of Ticket Check the Best":—

In introducing the subject, the author pointed out that it was a lengthy one, and that his remarks were primarily intended to draw a discussion. He discounted the idea of attempting to catch the dishonest conductor by means of a uniformed inspector, and suggested that those who are caught are probably the duffers. Opportunities for defrauding were specially great on small systems having few and well-known inspectors.

Having detailed some of the best known methods of the dishonest employé, the author suggested that detection would be far easier if some one travelling in plain clothes, and paying his fare in the ordinary way, were employed for the purpose. He suggested that there are always to be found a number of suitable men, or, better still, women, who are anxious to increase their income, and who, for an annual payment of £10 or so, would be willing to give their assistance. In this way, five to seven inspectors could be had for the wage of one inspector at present employed. It might be said that they would not give much of their time for this money, but it all depends on their occupation, and a choice could be made of those whose employment compels them to travel frequently, as it would be of more value to such persons in the way of keeping down their travelling expenses. They would never have to enter the tramway office, but could do everything by correspondence. Their outlays in tickets would be made good by their returning all tickets received, with the date, time, and place they entered and left the car, marked on them. They would act as a check on the conductor as to his having issued a proper ticket, for the part of the route travelled, and also on the inspectors, as the tickets would be compared with the conductor's waybill. Insurance agents, collectors, sanitary inspectors (male or female), &c., would do all very well for such purposes, and from the nature of their calling would be able to observe irregularities and make a reliable report.

A second system and perhaps a better one, is that all the municipal and company undertakings should form a detective staff of specially trained men and women, who would travel here and there over the different systems, never remaining long in one town; and for a fixed annual sum, according to the size of the undertaking, each company or corporation would have one or more of the detective staff sent down for a few days, several times a year. The good servants would welcome such a system, as it might be the means of bringing their number prominently before their superiors, and the rogue would have a wholesome dread of it.

In dealing with the subject we must not lose sight of the fact that we can never do away entirely with our uniformed inspectors, as they, too, have their uses, such as regulating traffic, giving the general public any information they may want, assisting now and then to make inquiries into accidents, &c.

The discussion did not reveal a great amount of confidence in the private detective, it being pointed out that the men for this purpose must have special tramway training.

Opinions differed as to the usefulness of the private checker, it being suggested that he demonstrated the honest dealing of the men which was satisfactory to the latter, and, on the other hand, that he became known and of little value, if permanent.

One speaker forcibly argued that conductors would not be so anxious to become drivers at 2s. $4\frac{1}{2}$d. per week extra, if they illegitimately increased their earnings to any extent, and suggested that a conductor's average earning per "guard mile" was a good indication of affairs.

The system of private detection adopted in the States, where the detective's word condemned a man, and his photo was later circulated throughout all the tramways undertakings, met with unstinted condemnation. It was further suggested that the passenger rather than the tramway employé might receive closer attention with profitable results—although here, there were difficulties in bringing a delinquent to justice.

The last paper of the session dealt with Mr. Raworth's system of regenerative control, and as this subject has been dealt with at length in the Electrical Review on several occasions, and as recently as August 12th and October 28th last, we merely append one or two notes on the discussion.

One speaker, with actual experience in the regular running of the Raworth car under traffic conditions, testified to the easy control and running of these cars, the latter in particular having excited comment among passengers. He expected to make some saving in power, but far more saving in brake-blocks and wheels, as, in the matter of brake-blocks, he used a pair per day per ordinary car in service during the busy traffic season.

Some disadvantage was found in that the cars could not make more than 5 or 6 miles per hour on up grades without sparking at the commutator.

The temperature of the motors after 12 hours' running had reached 160° F. In his opinion the system necessitated better trained drivers, as it was more easy to wreck the motors than with the series-parallel system.

The disability in regard to speeds on up-grades would, no doubt, be overcome by using larger motors and adapting them to the series-parallel system.

From other speakers' remarks it appeared that actual energy consumptions on different routes with ordinary cars varied from 2·8 units per car-mile on hilly, to ·63 units on flat routes at light loads. It was pointed out that the motors on Mr. Raworth's system would be 8 per cent. heavier than on the series-parallel system to do the same work, and that they had to deal with a much steadier current, although a continously applied one.

It has been provisionally decided that the next meeting of the Association shall be held at Bristol.

ELECTRO-CHEMISTRY AT THE ST. LOUIS EXPOSITION.

Some interesting papers on electro-chemical subjects were presented during the sittings of the International Congress and of the American Electro-chemical Society. In a country such as the United States, where natural water-power abounds, this branch of electrical industry is one of the first in importance, and is rapidly extending its field of operations.

One of the papers—that presented by Mr. J. S. Edstrom on the electrical extraction of nitrogen from the air—possesses special value on account of its bearing upon a most weighty question, namely, the maintenance of an adequate food supply for the inhabitants of the earth in future ages. The paper dealt with the process developed by Prof. C. Birkeland and S. Eyde, of Christiania, and formed an apt indication of the attention which is being given

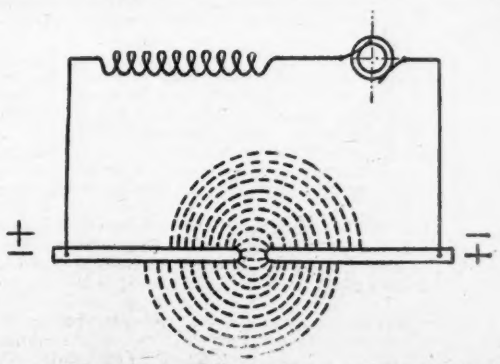


Fig. 1.—Diagram of System with A.C. Arc in D.C. Field.

to the question in Norway, where also abundant water-power is available. The system described depends upon the fact that the electric arc can be deflected by a magnetic field. The arc is struck between horizontal electrodes, in series with an inductance coil, and the magnetic field is applied by a powerful electro-magnet, the poles of which are brought close to the arc at right angles to the

electrodes. The arc is rapidly driven outwards, travelling back along the electrodes until it breaks, when a new arc is instantly formed between the tips of the electrodes, and is driven outwards in its turn, the successive arcs following one another so rapidly that, if desired, thousands may be formed in a second of time. In practice, the frequency is a few hundreds per second. When the arc and the magnet are both fed with direct current the arc is always deflected to the same side, but when alternating current is used for one and direct current for the other, the deflections are alternately on opposite sides, and the rapid succession of arcs gives the appearance of a disk; as the arc seems to move rather more quickly at the negative than at the positive end, the disk is slightly distorted when the arc is A.C. and the field D.C., giving the appearance shown in fig. 1. This is the arrangement generally used by the inventors.

The furnace or "oven" employed is shown in fig. 2, which is a vertical section at right angles to the electrodes. Air is forced through the channels, A A, into the chamber B, where it is brought into intimate contact with the electrodes E, before passing out by way of the channel C, carrying with it a proportion of oxidised nitrogen.

The advantages claimed for the system, in comparison with others, are the possibility of utilising larger powers in the arcs, and the economy which has been shown by experiment to result therefrom.

In one oven which is now in operation, from 75 to 200 KW. has been expended between one pair of electrodes, the arc being fed

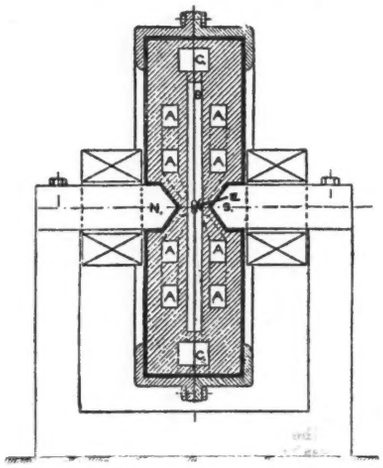


FIG. 2.—VERTICAL SECTION OF OVEN.

with alternating current at 5,000 volts, 50 cycles per second. The electrodes last for several hundred hours without renewal; they can be made of copper or iron, and so arranged as to be easily cooled with air or water. An oven for 500 KW. has been built recently.

The output of nitric acid obtained amounts to 900 kg. per KW.-year, showing a very high degree of efficiency; the energy stated is that consumed in the arc itself, and does not represent the whole input.

An enormous range of variations in the working conditions calls for consideration, such as the temperature, humidity and rate of flow of the air, the strength, voltage and frequency of the current, the strength of field, &c. The air, after treatment, contains 2 or 3 per cent. of nitric oxide, which is converted into nitrogen peroxide in an enamelled iron tank; from this it passes through apparatus for absorbing the acid, finally being brought into contact with caustic soda solution to extract the last traces from the air by the formation of nitrate and nitrite of soda. The strong acid obtained is either concentrated, or used for the manufacture of nitrate of calcium or potassium.

Mr. J. Swinburne's paper on "Chlorine in Metallurgy" gave a description of his process of treating ores with chlorine so as to convert the sulphides into chlorides, precipitating the metals with zinc and electrolysing the zinc chloride, and outlined the experimental work which had been carried out. The Castner-Kellner Co. has made arrangements to work the process with the exception of the concluding portion, the zinc chloride being sold, as the company's alkali works supply the necessary chlorine. The plant will shortly be in operation.

A paper on the electro-metallurgy of iron and steel was presented by Dr. P. L. T Heroult, who claimed that the French Electro-metallurgical Co., of Froges, was the only electrical concern which had produced high quality tool steels on a commercial scale during the past two years. The author does not advocate the smelting of iron ore in the electric furnace as a rule, as it is too costly, but he gives brief particulars of two methods by which it can be accomplished where electrical energy is very cheap. The chief application of the electric furnace is to the refinement of low-grade steels of any composition, and the production therefrom of steel of any desired composition, in one operation. At a cost of 2s. per ton, the author undertakes to convert any steel, delivered in the molten state, into metal containing less than ·01 per cent. of sulphur or phosphorus. The whole process is under perfect control.

A paper on the present status of the Edison storage battery was contributed by Messrs. A. E. Kennelly and S. E. Whiting on behalf of Mr. Edison. It was stated that no electrical depreciation of the cells or corrosion of the plates had been observed during the three years that the cells had been under observation; the capacity suffered no diminution, and the deposit at the bottom of the cells was insignificant. The cells are manufactured in three sizes, as shown in the accompanying table:—

Type.	+Plates.	−Plates.	Capacity in amp.-hours. Normal.	Max.	Charging current amps.	Charging time hours.	Weight complete kg.
E 18	12	6	110	140	40	3·75	5·66
E 27	18	9	165	210	60	3·75	7·95
E 45	30	15	275	350	100	3·75	13 6

The mean P.D. at normal discharge rate is 1·3 volts, varying from 1·65 volts down to 0·75 volt, but lies mainly between 1·35 and 1·25 volts. The internal resistance is practically constant, being 0·0022 ohm in the E 18 cell, and is nearly independent of the rate of discharge. The energy output amounts to about 14½ watt-hours per lb., from which must be deducted the loss in the cell, which depends on the rate of discharge; at 120 amperes discharge an E 18 cell has an actual output of 11·5 watt-hours per lb The charging E.M.F. is about 1·6 volts at the start, rising to 1·75 towards the finish. Oxygen and hydrogen gases are given off throughout the process of charging. As the mean P.D. of discharge is 1·3 volts, and of charge about 1 67 volts, the watt-hour efficiency cannot exceed 1·3 ÷ 1·67, or 78 per cent.; and, owing to the internal resistance of the cell, as well as to the ampere-hour efficiency being less than 100 per cent., it is always less than 78. When the cell is charged and discharged in four-hour periods, the ampere-hour efficiency is 75 per cent., and the watt-hour efficiency about 50 per cent. This disadvantage is compensated for, in the case of automobiles, by the rapidity of charge, which can be increased to double the above named rate.

The cells are remarkably immune from damage by careless treatment; they can be dried, short-circuited, or reversed, and are always restored to their full capacity by a prolonged charge. Their qualities render them peculiarly suitable for automobile service.

Many other papers were presented, relating to the chemistry of electro-plating, the carbon cell, the lead and silver voltameters, standard cells, &c., with which we need not deal here.

THE PASSIVITY OF METALS.

A USEFUL review of our existing knowledge upon this subject has recently appeared from the pen of Herr O. Sackur, in the columns of the *Chemiker Zeitung* (1904, xxviii., 954), and since the phenomenon in question possesses an electrical aspect, some of his remarks are worth noticing. The typical instance of passivity is the behaviour of iron when immersed in nitric acid having a specific gravity of 1·4. In that acid it remains perfectly "passive" or unattacked, whereas it dissolves and liberates hydrogen when treated with most other acids. When iron is connected with silver, copper, or lead in a bath of nitric acid, a galvanic element is produced in which the iron is the negative metal, the current flowing in the external circuit from the iron to the other metal In the ordinary way, iron stands between zinc and nickel in the electrical series of metals; when it is passive, it resembles a platinum metal, and fails to throw silver and copper out of solution. The phenomenon was first observed by James Keir in 1790. Faraday offered an explanation which, though disputed by Schönbein, remained generally accepted till some nine years ago. His idea was that a film of insoluble oxide, too thin to be visible, was formed upon the surface of the metal, and so protected it from further attack by the acid.

Gradually, however, facts were accumulated that showed Faraday's suggestion to be untenable. Passivity has been found to occur with copper, bismuth, tin, molybdenum, tungsten, niobium, vanadium, ruthenium, and perhaps aluminium; and more conspicuously still with chromium, nickel and cobalt. Were the protective agency a film of oxide, that substance would differ from the known oxides of iron by being a conductor of electricity. Moreover, the fact that passive iron, and more especially passive chromium, do dissolve (though slowly) in nitric acid without liberation of hydrogen, yielding compounds of the highest possible degree of oxidation (*e.g.*, chromic acid), is not consistent with the presence of a protective film of insoluble oxide. Micheli, and Müller and Koenigsberger, have proved by an optical method that passive chromium and iron cannot be covered with any film thicker than a wave-length of light; and although, according to Bredig and Weinmayr, a film of such tenuity may be capable of exerting a catalysing influence, it can hardly be imagined able to protect the metal so thoroughly. Besides, the gradual change from passive to active state, which all later observers have noticed, cannot be reconciled with an oxide film.

Hittorf has suggested that the molecules of a passive metal are in a special "state of tension," but offers no hypothesis as to what this may be. Other writers have used the expression, "allotropic modification." As the passive form of a metal exhibits the lower potential, it should be the more permanent; but in ce tain circumstances it changes of itself into the active form. W. J. Müller has brought forward a theory based on the notion that only metals of variable valency can become passive—which leaves the passivity of bismuth and aluminium to be explained in some other fashion—and on the fact that metals can only become passive when they are made anodes. According to the Drude-Riecke theory, there is an equilibrium in the metal between positive material ions and free negative electrons. When the metal is made an anode, the latter migrate from the surface where the metal touches the electrolyte; and therefore the positive ions have every opportunity of taking

up their maximum positive charges. This theory explains very clearly why a passive metal always passes into solution in its highest state of valency, and why it is rendered active when made a cathode; but it does not explain why metals are only capable of assuming the passive condition in the presence of certain anions, *e.g.*, NO_3', SO_4'', CN', while in that of others, such as Cl' and Br, they dissolve and give less highly oxidised compounds.

Quite recently Fredenhagen has offered a suggestion, which in many respects resembles Faraday's original idea, viz., that the dissolution of a passive metal is hindered by a protective film, not of oxide, but of gas or oxygen; and this view apparently removes many of the objections urged against the film. Le Blanc, however, holds that passivity is neither due to an alteration in the equilibrium of the metal nor to the production of a protective film, but simply consists in a lowered velocity of reaction. To what this reduced velocity may be due, is unknown; but several phenomena, such as the frequently observed change from the passive to the active state, and the dependence of passivity upon external circumstances and apparent accidents, favour the supposition. Moreover, the relationship established by Mugdan between the rapidity of oxidation of iron and its electrical potential points in the same direction. On the whole it must be admitted that practically no more is understood about the cause of passivity now than in the days of Keir and Schönbein.

LEGAL.

The Chepstow Gas and Coke Consumers' Co. *v.* The Chepstow Electric Light and Power Co.

In the King's Bench Division of the High Court of Justice on November 4th, the Lord Chief Justice, Mr. Justice Kennedy and Mr. Justice Ridley in this case heard an appeal by way of special case on behalf of the Chepstow Electric Light Co. from a conviction and fine by Justices of Monmouth. It appeared that, on May 31st, complaint was made by the Gas Co. that on and since October 2nd, 1903, the Electric Co. had made default in complying with certain requirements of Sec. 18, Sub-Sec. 1, of the Electric Lighting (Clauses) Act, 1899, in having laid down and constructed new electric lines and other works in certain portions of St. Mary's and other streets in undue proximity to the mains or pipes belonging to the Gas Co., and did not conform, and has not conformed, with such requirements as were made by the Gas Co. for protecting from injury their mains, pipes and other works, and for securing access thereto. A summons was issued against the Electric Co., and heard on June 17th, when the Electric Co. were convicted. Before the opening of the case the Electric Co. took the following objections:—That the Court had no jurisdiction, inasmuch as there was a special method of recovery provided under Sec. 18 of the Electric Lighting Act, 1899; that the complaint was not made within six calendar months of the time when the matter of the complaint arose; and that the matter of the complaint had already been the subject of arbitration, that the arbitrator had determined the complaint, that his award was final, and that the Gas Co. were barred from proceeding for the recovery of penalties in the Court. These objections the magistrates over-ruled and heard the evidence, when it was proved that the Electric Co. did not give the Gas Co. notice as provided by Sec. 18 of the Act before commencing to dig trenches for their lines near to the mains of the Gas Co. in respect of any of the work carried out by the Electric Co. between September 7th and November 13th, 1903, and that the electric lines of the Electric Co. were laid in undue proximity to the gas mains, and not in accordance with the requirements which had been made by the Gas Co. for protection from injuring their mains, pipes, and other works, and for securing access thereto. It was also proved that the Electric Co. had not altered the situation of the lines since the date of the arbitration, and that the work of laying the electric lines was completed by October 31st, 1903. The Justices considered the complaint and information sustainable in addition to the arbitration proceedings, and accordingly convicted the Electric Lighting Co., and fined them £1 and costs, and a daily penalty during default of £1. The question for the opinion of the Court was whether their decision was right in point of law.

Mr. Shiress Will, K.C., appeared in support of the appeal for the Electric Co., and contended that there could not be a conviction for daily penalties until after there had been a conviction, and took the various points mentioned in the judgement.

Mr. M. Macmorran, K.C. (with him Mr. Lushington) for the Gas Co., supported the conviction. He said that penalties in addition to compensation was one of the means of enforcing the requirements. The complaint was that the electric wire were laid in some cases over the gas pipes. So long as the requirements of the Gas Co. were not fulfilled they had a grievance, and the offence arose from day to day. Under these circumstances there was a necessity for a continuing penalty. The point contemplated by the conviction was failure to comply with the requirement, which was to open the trench and shift the electric main a little way from the gas pipes. The whole tenour of the section went to show that the offence was not the mere laying down of the pipe, but not complying with the requirements.

The Lord Chief Justice said they were of opinion they could not interfere with this conviction. The proceeding was commenced by information and summons under Sec. 18 against the Electric Light Co. for that they had laid down and constructed certain new electric mains in undue proximity, and had not conformed with such requirements as were made on behalf of the Gas Co. One saw, of course, how that statement made as to laying down the mains in undue proximity got into the summons. It was because there had been proceedings before Major Cardew in regard to these wires, and he had found as a fact that the wires were in undue proximity, and went on to find the company had not obeyed the requirements of the Gas Co. He desired to point out that the offence here was not an offence of laying down wires in any given position, but machinery was provided whereby certain people whose interests were affected—as, for instance, the Gas Co.—might make requirements on notice being given to them, that they had a means of recovering any damages done, and there was a provision for arbitration. But Sec. 5 made the substantive offence, default in complying with any of the requirements of the section. And so far as this was concerned, the only requirement of the section was not conforming with reasonable requirements made by the officers of the company for protecting the gas pipes. Therefore, they had to consider whether or not the time limit of six months' in Jarvis's Act, which was relied upon in this case, applied so as to make the conviction either bad upon the face of it as bad on the facts stated by the magistrates, showing that there had been a complete offence for more than six months. It was contended first by Mr. Will that there could be no summons for a penalty at all, because the matter had been referred to Major Cardew. They were clearly of opinion that was not a good point. Not only did the section say the penalty was to be in addition to compensation, but it was obvious the provision for a penalty had no necessary relation to the compensation. It might very likely be the penalty was for the purpose of enforcing obedience to some requirement which did not involve compensation at all, and yet might be found to be reasonable, as, for instance, the putting of the mains at any given distance from the gas pipes found to be right by the arbitrator. That, he thought, was made clear, because there was a daily penalty added, showing that this provision regarding penalty had nothing to do with the compensation to be paid to the Gas Co. On that Mr. Wills contended that the Gas Co. could not take out this summons, although their requirements had not been acceded to, because the arbitrator awarded compensation. He thought there was no ground for interfering. Mr. Will then contended that the conviction was bad, because, in addition to a £1 penalty, it went on to say "and £1 for every day in default." Mr. Macmorran admitted that a conviction for an offence could not add on penalties for future offences, especially when it was remembered that it was provided by the Act that a penalty on default should be after conviction. They all thought that was a matter which did not affect the conviction, and the only result of their order on that would be that that be struck out from the conviction, and no effect would be given to it in the event of any event being made to enforce the penalty. The difficult point was that the information was laid too late. The question was whether Mr. Will was right in his contention that, because the conviction related to something done as far back as October 2nd, as mentioned on its face, that the company on and since October 2nd made default in obeying the requirement, the conviction was bad. He was clearly of opinion that was not an objection to be taken to make the conviction on the face of it bad. There was a broader view to be taken of this case—that this requirement was for the purpose of this offence—assuming it to be a proper requirement, put in the position of disobedience. In this case it seemed to him it was possible the magistrates might have thought that the offence, namely, disobedience to the order, was of such a character that there was a completed offence at a certain time. Having regard to the language of the order, and the facts as found by the magistrates, that question could not arise, and could not be relied on in this particular case. In this case the present appellants were disputing that the mains were too near for more than 4½ months after the question was raised, and then there was a requirement to them to comply with what the Gas Co. wanted after the date of the award. It was not possible for them to allege this conviction as alleging a completed offence on October 2nd in respect of which the penalty might have been inflicted, but there was nothing to show the offence was complete of not conforming to the requirements more than six months before the summons was taken out. He was, therefore, of opinion that the appeal failed, and must be dismissed with costs. The other Judges concurred.

Attorney-General *v.* The Urban Electric Supply Co.

This case was in the list for hearing before Mr. Justice Joyce, in the Chancery Division, on Monday.

Mr. Hughes, K.C., said he appeared for the Attorney-General and the relators, but he wanted time to consider the matter, and possibly to put in further evidence. He accordingly asked that the hearing might be adjourned until Monday or Tuesday next.

After some discussion, it was arranged that his Lordship should hear the case on Saturday, the 19th inst.

Claim by Electrical Engineers.

Mr. Justice Ridley, in the King's Bench Division on Monday, had before him an action by Messrs. Ryder & Co., of 27, Chancery Lane, to recover from Messrs. Dracott & Co., art photographers, 363, Oxford Street, the price of certain repairs. Plaintiffs had contracted to substitute an electric motor for a gas engine for the purpose of working a lift. Defendants subsequently complained that the belting caused noise and vibration, and asked plaintiffs to put it in proper order. Plaintiffs did so, and demanded payment,

but the defendants contested the claim, holding that, under the original contract, plaintiffs ought to have put the lift in proper working order.

After hearing evidence, his Lordship gave judgement for the plaintiffs for the amount claimed.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

Intercommunication of Tramway Systems.

I am very glad to see from a letter in your issue of October 28th, signed by Mr. J. R. Salter, that "his grandmother is very much alive," but what this has to do with my letter of October 8th, protesting against your making statements with respect to the action of the Bolton Corporation Tramways Committee, when you had not taken the trouble to hear both sides of the question, I fail to see.

Mr. Salter, in a long letter, quotes extracts from the *Bolton Weekly Chronicle* and *Bolton Evening News*, but none of these affect the question, as I have never disputed that during the time the Bolton Corporation trams were running on the South Lancashire lines, and, *vice versâ*, our receipts were very good; in fact, the statements made in the above extracts are quite true. Record receipts "on the whole system" were taken during that time, but this does not invalidate my statement of fact in any way, because the South Lancashire tramways system only couples up to the Bolton system at one point, viz., the outward terminus of the Daubhill route. If, therefore, the total receipts (which were really due to exceptionally fine weather and holidays) had been due to our connection with the South Lancashire tramways, the receipts on the Daubhill route would have been phenomenal. This was not the case, and I can prove, without doubt, that money was lost on this route in consequence of our connection with the South Lancashire tramways at that time. It is true, as Mr. Salter mentions, that I was not general manager of this system at the time, but I spent a considerable portion of my time on this route with the particular object of observing how the traffic worked, and can state, as an eye witness, that what I said in my previous letter was an absolute fact, and whatever evidence Mr. Salter may think he has to the contrary, I do not think he will claim that it is from his own observation of what actually took place.

I do not say that the receipts on the South Lancashire system were not increased, it may well be that they were, but that we derived no benefit from the connection, and that, in fact, the trial was a failure from our point of view, I can personally vouch for.

Mr. Salter comments upon our want of cars, as mentioned in the extracts he quotes; but if he had been at our terminus where we were running the service previously arranged, he would have seen that frequently we had to turn out passengers and turn back our own cars, because the cars on his own system did not make the connection, and if this had not been done, the service on the Daubhill route of our system would have been such that the traffic would in no sense have been catered for.

Mr. Salter also says that he is delighted to know that the Bolton Corporation are now anxious to run in conjunction with any neighbouring authority, but he leaves out the condition which I mentioned in my letter, viz., "if it paid," and then professes to doubt the meaning which I attach to local authorities, by which I presume he means neighbouring authorities, as mentioned in my letter, and I will say here, at once, I have no special meaning for neighbouring authorities as to whether they are companies, municipalities, or any other authority likely to have charge of a tramway system.

Mr. Salter next quotes a clause from the South Lancashire 1903 Act, which was inserted at the request of the Bolton Corporation, but he does not mention the fact, which is of far more importance, that at the present time (and for a considerable time) their system is connected through to the Bolton Corporation system at the only point where it can be so connected, so that, although the Corporation required the above-mentioned to be included in their Bill, they have not taken advantage of it, but have given permission for the junction to be made without any reference to the Board of Trade.

I must apologise for having occupied so much of your space for a subject which I did not introduce, and which it does not seem to me should be discussed in the pages of a scientific review.

Arthur A. Day,
General Manager, Bolton Corporation Tramways.

Bolton, *November 3rd*, 1904.

Engineers and Christmas Boxes.

In some restaurants and hotels the wages of attendants are merely nominal. In others, the attendants pay for the privilege of being in a position to receive tips. Where tipping is recognised, it exercises an inevitable effect on salaries. In trading houses, the Christmas gift to buyers in other warehouses is, or was, common enough. It was so common that it was done openly, and the Christmas gift wagon, laden with, perhaps, 100 cheeses or as many turkeys, boldly went the round of the warehouses—we are referring particularly to a certain town not noted for municipal purity—and deposited its quota of gifts. Everyone knew of it, and, as often as not, the recipients divided the spoil with the office, for, as one of them said, "I wish they wouldn't send their d—— turkeys, I can't eat 10 of them."

Engineers are supposed to be different; they are by courtesy expected to be honourable men, above either bribes or presents. Yet it is not only too well known that, not in a paltry Christmas present, but in a big commission paid by the contractors, there are many of them making profit out of nearly every bit of machinery they buy. Indeed, there are those who do not hesitate to attribute some of the extensions that are made to the engineers' wives' importunity for gewgaws, and we have known an irritable contractor, driven to desperation over the nagging of an engineer, turn round and abuse him in strange oaths, telling him straightly that, because he had not joined in the purchase of a certain article, he could not get his goods passed.

And is it not a common subject of discussion among contractors whether such and such an engineer is or is not "amenable?" Contractors sometimes get the wrong sow by the ear, and offer tips to non-takers. It is a difficult subject this offering of tips to a man whose habits are not known. As to so and so, they will say you may go for him straight.

Mr. X, however, must have gold and no witnesses. Various are the dodges which I will not describe, lest we fall into too accurate particulars.

The evil in the electrical industry is not confined to Christmas presents of the ordinary type. It extends all the year round, and has been even claimed to aspire to the height of bicycles, and even motor cars. Nor have all engineers even the grace of shame. As "Constant Reader" says, some are not above stating what articles they—or their wives—stand in need of. Is it true that some contractors keep a sort of personal ledger in which the record is kept of all engineers coming under their ken, whether for good or evil? In process of time the large amount of corruption which undoubtedly does exist will be assumed to be of even greater dimensions, and the tendency will be to take it into account in fixing salaries. Indeed, does this not already, to some extent, prevail more or less unconsciously? Chief engineerships will be offered to the highest bidder, and the electrical engineer will then be in sympathetic unison with the waiter who grumbles at the paucity of his tips.

That a gross evil does exist is certain. It may be difficult to prove it. Names do not pass readily in conversation, except among very intimate acquaintances. Disrepute is brought upon all electrical engineers, both good and bad, and there ought to be a determined effort made to stamp out the evil. Perhaps some day a complete exposure of the whole nefarious business will take place, and not only are those not to be envied who may be shown up, on account of the disgrace attached to them, but they will stand in danger of prison, for these illegal commissions to paid servants are punishable offences.

Until engineers behave in a manner befitting gentlemen,

it is hopeless for them to expect professional treatment. Boards of Guardians do not, we believe, even treat the medical profession in the way that electrical engineers are treated by municipal committees. Can it be wondered at!

Mentor.

Electrical Engineers, R.E. Volunteers, at Birmingham.

I have just heard, quite casually, that there is a company of Electrical Engineers, R.E.V., in Birmingham, and that it has been in existence for about four years. I, myself, like many others, would have liked to have associated with it, but we have seen no notices or regimental orders in your pages. Surely there must be some oversight on the part of the authorities, as we naturally look to the electrical Press for this sort of news.

A.M.I.E.E.

[We have inquired at headquarters, and are informed that there is a detachment of this corps at Birmingham, under the command of Lieut. J. F. Lister. At present the detachment consists of about 60 of all ranks, and has headquarters at the Argyle Hotel, John Bright Street; the instruction and other work is carried on there every Monday, Wednesday and Friday night, from 7 to 11 p.m., when anyone wishing for information as to joining, &c., can obtain it.—Eds. E.R.]

Employment Bureau.

With regard to the recent discussion in the Review on the employment of labour, and the manner in which all classes of men term themselves electrical engineers, I beg to offer the suggestion that the I.E.E. might do more for the profession if it would form an employment bureau, where men in want of an appointment could send in their names and experience, and employers, in their turn, might apply, these being then put into communication with a suitable man. It would certainly save a great deal of trouble, would be somewhat of a guarantee that a man is what he claims to be, and would certainly help on the Institution, as a sum might be charged for registration, besides inducing larger numbers to join its ranks.

Might we be favoured with the views of Mr. Lloyd upon this subject?

J. F. C.

[The establishment of such a bureau was mooted some years ago, but up to the present it has not been carried into effect. The latter part of our correspondent's letter raises very difficult questions; we doubt whether it would ever be possible for the Institution to accept any responsibility in the shape of a guarantee as to the qualifications of its applicants for employment.—Eds. E.R.]

Home Office Draft Regulations.

I am somewhat surprised to see that apparently nothing is being done by owners of works, &c., with regard to the above proposed regulations. While no one will object to rules being made to ensure the proper erection and maintenance of electric plant and apparatus, these draft regulations (if passed) will bear hardly on manufacturers who have been sufficiently enlightened to equip their works with modern electric power and lighting machinery. As most power plants are now arranged to be worked at pressures well above 250 volts, to encase all the wiring in metal tubing will entail considerable expense, and will greatly upset working arrangements, especially in places where the process of manufacture is more or less a continuous one, and where the machinery cannot be stopped except in cases of breakdowns.

No mention is made in the draft regulations as to a time limit, during which all installations must be arranged to conform with these rules—the inference being that any necessary alterations must be done immediately these rules come into force. To a manufacturer whose works are equipped on the three-wire system, with 250 volts, or more, across the outers, it evidently means a considerable outlay n re-arranging all his internal wiring—to say nothing of the oss and annoyance caused by the stoppage of machinery while these alterations are being effected. Surely, something ought to be done to secure an ample period of time in which to execute these alterations, or better still, to obtain exemption for all work executed prior to January 1st, 1905.

Every owner of works, for his own pockets' sake—to put it on the lowest level—will ensure sufficient care is taken to prevent serious accidents happening to his employés, though no number of rules or regulations will prevent a man from wilfully endangering his life.

One is rather curious to know how the Home Office proposes to earth lampholders at the end of a flexible cord, and this apparently has to be done in cases where lamps are wired in series on 250 volts or more, this practice being a very common one in some works.

No one can find fault with the requirement that all motors, switch-cases, &c., should be earthed; but that all wires should be encased in metal tubing is a much more debateable question.

W. H.

[Whether the regulations, which are only in *draft* as yet, will be made retrospective or not is not clear; but our correspondent, we think, takes too gloomy a view. The wires need not be put in *tubing*; they can be covered with metal casing of any kind. Where the 250-volt three-wire system is in use, if the neutral is earthed—through a resistance, or direct—the installation is exempt from the operation of the regulations. All objections addressed to the Home Office will receive attention and consideration.—Eds. E.R.]

Lead-Covered Wires.

After reading Mr. Mackenzie's letter appearing in your last issue, I think that I have been a most unfortunate individual in regard to my experience with lead-covered wire. About four years ago I had occasion to use lead-covered wire for lighting a carriage drive about 400 yards long, the wire was carefully drawn into 1¼ in. iron barrel in the ground, and at the end of each coil, also at each point where a light was taken off the circuit, a brick box was built, lined with cement and fitted with an air-tight inspection cover. The number of wires running through each box are five (part of the lights being on two-way switches), the sizes are 7/20 and 7/22. This installation has always been a source of trouble and annoyance, twice have we been obliged to draw out the whole of the wires, cut out the faulty portions, and reinstate, with part new each time. All the fault seems to be in the imperfect insulation between the wire and the lead cover, in some places we find the insulation and the lead quite gone on one side, and the other side intact; in others, chemical action is taking place, appearances pointing to the fact that the lead is of very inferior quality. I should very much like to know if anyone has had a similar experience, and would be grateful for any suggestions which would enable me to make this installation as successful as those of Mr. Mackenzie.

T. H. Bands,
(Electrician to Messrs. Cowtan & Sons, Ltd.)

London, W., *November 8th*, 1904.

Mr. John D. Mackenzie has published in your last issue a supplement to my article of the previous week. The former paper was entitled, "Notes on Faults in Small Lead-Covered Wires." Mr. Mackenzie's letter might have been called "Notes on Virtues"; with some suggestions for lessening the admitted dangers of L.C. wires. The point of his letter is in the last clause, which says, "the ease with which old and finished houses can be wired on this system is unsurpassed." I quite agree. It is possible to suggest other equally convenient modes. But certainly steel tube for a finished house requires skilful planning if it is not to be a cumbersome and destructive device. Wood casing, also, as commonly run, is most unsightly. It is, therefore, with regret that I so often forego the convenience of lead-covered wires, because of the disadvantages detailed by me.

Mr. Mackenzie appeals to his own experience with it; he has, he says, with L.C. wire had one fire, which he attributes to "spontaneous ignition." I did not include that danger in my list.

No one questions that L.C. wires can be made reasonably safe for interior wiring. Continental practice proves that twin flexible, and that of inferior quality, buttoned to small insulators, can be used with success, especially with moderate voltages. The worst possible system well fitted is better than the best badly fitted. What we require is a system safe when fitted by Messrs. Tom, Dick and Harry, and not needing to be nursed into safety by exceptional men. I admit, however, that such a system when it comes will not be altogether to the commercial advantage of those of us who bestow much care on our work.

I would like—following Mr. Mackenzie's example—to have referred to his points *seriatim*, but will content myself with a remark on a few.

The average wireman is a part of any system.

A combination of lead sheath, brass boxes, copper wires and solder would, in a damp place, provide every facility for local electrolysis. Where this made a good job, everything must have been dry, and bare wires properly laid would have made the like.

Separate L C. wires are better than twin, but not much if they are bunched and bonded together. When the two "earths" equal one "short," it is apt to do more damage than when the two live conductors are in one cover.

Lead saddles are right. But they are not so neat, and they need other metals to fix them.

Mr. Mackenzie recommends close joint tubes for protection against the furtive and frequent family nail. Electrolysis again. It would be about as easy to make the tube lap-welded at once, and save the lead.

Where wires are not in plaster, "a piece of wood casing will do nicely"—agreed—especially if the wire be not lead-covered.

The electrocution of deserving rodents is desirable, but expensive. Many plumbers possess a well-stocked museum of corroded water-pipes; and corrosion which would be trifling in a thick water-pipe, would be fatal on a thin wire sheath.

I end as I began, by admitting your correspondent's claim that L.C. wires are often convenient to fit. I would go further, and say that, in some places, both wet and dry, it is the right thing to use. Yet it is well to be alive to its dangers.

Donald Smeaton Munro.

Glasgow, *November 7th*, 1904.

Exhaust Silencer.

I shall be much obliged if either you or one of your readers can give me information as to the cheapest means of silencing the noise of the exhaust of a 150-H.P. steam engine. The exhaust pipe is carried straight up through the roof of the engine house, and it will be a difficult matter to carry this pipe out into a box or tank in the ground.

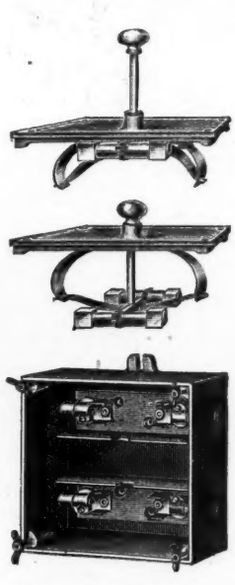
H. Willoughby Lance.

Llandudno, *November 8th*, 1904.

BUSINESS NOTES.

Combined Ironclad Switch and Fuse.—A unique pattern of combined ironclad switch and fuse has lately been designed and patented by Mr. Herbert H. Berry, of Berry, Skinner and Co., to meet the requirements of engineers who want a strong dust and watertight ironclad switch and fuse for electric lighting and power work, and suitable for all voltages up to 550. The latest designs of this apparatus differ in small degree from the accompanying illustrations, certain minor improvements having been introduced; for instance, the iron covers are now hinged to one side of the switch-box, and fixed by means of swivel wing nuts, with effective provision for sealing. The inventor claims that no other apparatus on the market can be shown to fill each and all of the following conditions:—(1) To be of great mechanical strength and sound design; (2) to be free from springs likely to get out of order; (3) to be dustproof, flame and watertight; (4) to stand a dead short across both poles simultaneously, at 550 volts, without arcing to the cover; (5) to be provided with rapid make and rapid break. (6) It must be impossible to leave the switch in an intermediate position between "on" and "off." (7) It must be impossible to replace the fuses while the switch is in circuit. (8) It should be possible for the operator to open the switch and replace a blown fuse in 30 seconds, without touching or coming into close proximity with any live parts. (9) The switch and fuses should, if possible, be combined under one cover, if additional safety can thereby be assured, in order to avoid the widely adopted and somewhat inadequate method of using separate switches and separate S.P. fuses, with the consequent unsightly short lengths of connecting cables, and to save space, preserve neat appearance, to save the wireman's time in fixing, and the cost of cable ends, and so forth. In a good many copies of "wiring regulations" it is forbidden to place a switch and fuse under one cover, although in a number of cases this regulation has been altered, or is about to be altered. When the majority of the existing "wiring regulations" were drawn up, there was apparently no other course open on account of the fact that the designs of apparatus then existing were not free from danger. It is, however, stated that with this apparatus not only is the danger removed, but additional safety is gained over the older

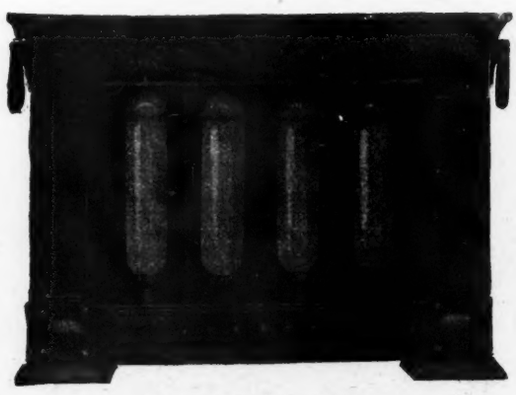
Switch Closed.



Details of Switch.

methods. We are informed that close upon 200 complete sets of these switches in varying sizes were ordered during one week of October by various well-known borough engineers, one of whom has sent a report to the effect that he has adopted this switch fuse, as it seems to be most suitable for motor work, and it is perfectly fool-proof, as is required in such switches. The engineer further remarks that his department has adopted this switch fuse as the standard for use in motor installations.

Electric Radiators.—Messrs. Veritys, Ltd., of 31, King Street, W.C., have issued a neat little 32-page booklet, dealing with their electric radiators, of which several novel designs have been



"Rising Sun" Radiator.

prepared. We illustrate one of them herewith—the "Rising Sun"—in antique copper or oxidised silver. There should be good business in this line as the cold weather sets in.

Natal.—The value of the British electrical fittings imported into Natal during last year amounted to £47,300. Similar imports from Germany attained a value of £5,000, and from the United States £6,000.

Electrical Wares Exported.

Week ending November 3rd, 1903.

Alexandria	.. .. ..	Value £20
Amsterdam	.. ..	75
Azores	.. ..	500
Bombay	.. ..	90
Buenos Ayres	.. ..	157
,,	Teleph. cable	1,050
Calcutta	.. ..	1,315
,,	Teleg. mat. ..	770
Cape Town	.. ..	45
Chinde	.. ..	59
Delagoa Bay.	Teleg. mat. ..	7,321
Durban	.. ..	850
,,	Teleg. mat.	83
East London	.. ..	977
Fremantle	.. ..	416
,,	Teleg. mat. ..	225
Ghent	.. ..	35
Gothenburg	.. ..	15
Hamburg	.. ..	36
Hong Kong.	Teleg. mat. ..	51
Kingston, Ontario	.. .. ..	30
Maceio	.. ..	21
Madras	.. ..	328
Melbourne	.. ..	145
,,	Teleg. cable ..	1,530
Penang.	Teleg. mat.	19
Perth	.. ..	167
,,	Teleg. mat.	60
Port Elizabeth	.. .. ..	432
,,	Teleg. mat. ..	50
Port Said	.. ..	68
Rio de Janeiro	.. .. ..	74
St. Petersburg	.. .. ..	400
,,	Teleg. cable ..	115
Shanghai	.. ..	247
Singapore.	Teleg. mat. ..	776
Stockholm.	Teleg. mat. ..	19
,,	Teleg. wire ..	170
Sydney	.. ..	514
Toronto	.. ..	85
Tripoli.	Teleg. mat.	202
Vancouver, B.C.	Teleg. apps. ..	180
Vera Cruz.	Elec. cable. ..	2,433
Wellington	.. ..	20
,,	Teleg. mat. ..	1,120
Yokohama	.. ..	207
Zanzibar	.. ..	20
Total	..	£23,522

Week ending November 1st, 1904.

Adelaide	.. .. ..	Value £622
Alexandria	.. ..	162
,,	Teleg. mat. ..	457
Amsterdam	.. ..	59
,,	Teleg. wire ..	154
Bombay	.. ..	1,785
Boulogne	.. ..	19
Bremen	.. ..	93
Buenos Ayres	.. ..	167
Calcutta	.. ..	290
,,	Elec. machinery ..	743
,,	Teleg. mat.	143
Callao.	Teleg. mat.	108
Cape Town	.. ..	43
Christiania	.. ..	25
Colombo	.. ..	8
Copenhagen.	Teleg. wire ..	9
Durban	.. ..	939
,,	Elec. machinery ..	560
,,	Teleg. mat.	730
,,	Teleph. cable	427
East London	.. ..	20
Fremantle.	Elec. machinery. .	118
Genoa	.. ..	22
Gibraltar	.. ..	38
Hong Kong.	Cable	40
Jamaica.	Teleg. mat.	5
Lisbon	.. ..	31
Madeira.	Teleg. instruments. .	27
Malta	.. ..	122
Melbourne	.. ..	150
,,	Tramway cable ..	645
,,	53 cwt. teleg. wire. .	—
Monte Video	.. .. ..	82
Paris	.. ..	15
Penang	.. ..	134
,,	Teleg. mat.	110
Perth	.. ..	70
Port Elizabeth	.. .. ..	348
Rio Grande.	Teleg. instruments	210
Rio Janeiro	.. ..	1,027
St. Petersburg	.. .. ..	290
,,	Teleg. apparatus	2,540
Santos	.. ..	668
Shanghai	.. ..	101
Singapore	.. ..	969
,,	Teleg. mat.	152
Sydney	.. ..	1,245
,,	Teleph. cable	277
Trinidad	.. ..	100
Wellington	.. ..	236
Total		£17,335

Foreign Goods Transhipped.

Brussels.	Elec. mat. ..	Value £80
Fremantle.	Elec. mat. ..	.. 1,117
Lisbon.	Teleg. mat. ..	.. 17
Port Elizabeth.	Elec. mat. ..	97
Total		..£1,311
Sydney.	Elec. mat. ..	Value £40

Stewart Arc Lamp.—It is well known that in this lamp for direct current a choking coil is substituted for the external resistance, the operating mechanism of the lamp consisting merely of two coils and a dashpot, mounted on the central tube, and operating a clutch of simple construction. The choking coil is placed in series with the series coil, and the shunt coil is shunted round the choking coil and the arc. It is found in consequence that the lamp will burn with a potential difference of only 13 volts between the line and the arc, as against 30 volts with other types of lamps; and the higher potential difference, by lengthening the arc, increases substantially the hemispherical candle-power. A very careful comparison was made recently at the Electrical Testing Laboratory of New York between this lamp and a standard enclosed arc lamp burning at 80 volts in the arc, and we are informed that the mean result of a series of observations of spherical candle-power was to show an efficiency in the lamp with choking coil, of over 40 per cent. beyond that of the standard lamp. This result will be seen to correspond pretty closely with what would be expected from a comparison of the energy which is used instead of being spent in an external resistance, and of the increased length of arc which is obtained. The lamp, in conjunction with the other Stewart lamps, is supplied by Messrs. J. Defries & Sons, Ltd., of 146 & 147, Houndsditch, London, E.C.

Germany.—So far, this year, there has been a noticeable increase in the importation of foreign electrical machinery into Germany, the returns for the eight months ending with October last showing a total of 864 tons, as compared with only 524 tons in the corresponding period of last year. There has also been a slight increase in the exports of German electrical machinery—from 8,580 tons in the first eight months of 1903, to 8,584 tons in the eight months ending with August last.

Electric Burglar Alarms.—The Imperial Industries Club visited Wolverhampton, on Friday, as the guests of Sir George Hayter Chubb, and were greatly interested in the innovation of wireless telegraphy as a burglar alarm. Eighty of the members visited the famous lock works and inspected the new apparatus fitted to a safe. Tampering with the door of the safe immediately set at work a small but powerful transmitter, causing the safe to radiate waves in all directions, sufficient to ring alarms in any part of the building. The party also visited the large works of the Electrical Construction Co.

Ventilation.—The North British Station Hotel, Glasgow, is to be ventilated with electric fans, which are being supplied by Messrs. Matthews & Yates, of Cyclone Works, Swinton, Manchester, who have also supplied the fans for the company's hotel at Edinburgh. The same firm have just completed the erection of a humidifying and ventilating apparatus at Messrs. A. Barlow and Sons' Union Mill, Blackley, near Manchester.

Electrical Wares Exported.

Week ending Nov. 10th, 1903.

Alexandria	.. .. ..	Value £209
Amsterdam	.. ..	50
Antwerp	.. ..	248
Auckland	.. ..	400
Bangkok	.. ..	275
Bombay	.. ..	1,168
Brisbane	.. ..	16
Brussels	.. ..	130
Calcutta	.. ..	351
Cape Town	.. ..	441
Chemulpo	.. ..	40
Colombo	.. ..	73
,,	Teleg. mat.	887
Delagoa Bay	.. .. ..	257
Durban	.. ..	1,512
,,	Teleg. mat.	147
East London	.. ..	798
Flushing	.. ..	65
Fremantle	.. ..	32
Gibraltar	.. ..	207
Hong Kong	.. ..	460
Launceston.	Elec. machinery. .	798
Lyttelton	.. ..	67
Melbourne	.. ..	11
Montreal	.. ..	17
North Sea.	Telegraph cable ..	1,214
Perth	.. ..	39
Port Elizabeth	.. .. ..	162
,,	Teleg. mat. ..	196
Rangoon	.. ..	407
Rotterdam	.. ..	30
Shanghai	.. ..	682
Singapore	.. ..	81
Sydney	.. ..	507
Wellington	.. ..	301
Yokohama	.. ..	194
Total	..	£12,549

Week ending November 8th, 1904.

Adelaide	.. .. ..	Value £26
Alexandria	.. ..	30
Amsterdam	.. ..	265
,,	Teleg. wire ..	194
Auckland	.. ..	168
Bangkok	.. ..	8
Bermuda	.. ..	26
Bombay	.. ..	418
,,	Elec. machinery ..	20
,,	Teleg. mat.	26
Bremen	.. ..	50
Brisbane	.. ..	203
,,	Teleg. mat.	440
Buenos Ayres	.. .. ..	784
Calcutta	.. ..	5
,,	Elec. cable	104
,,	Elec. machinery ..	1,567
Cape Town.	Elec. machinery	1,169
,,	Teleg. mat. ..	673
Christiania	.. ..	19
,,	Teleg. mat.	14
Colombo	.. ..	20
Copenhagen.	Elec. cable ..	134
,,	Teleg. mat.? ..	19
Demerara	.. ..	46
Durban	.. ..	1,293
,,	Teleg. mat.	91
East London.	Elec. machinery	1,869
Fremantle	.. ..	22
Gibraltar	.. ..	730
Gothenburg	.. ..	27
Hamburg.	Teleg. mat. ..	14
Hobart	.. ..	18
Hong Kong.	Elec. mat. ..	269
,,	Elec. machinery	110
Kobe	.. ..	160
Lyttelton	.. ..	112
Madras	.. ..	35
,,	Elec. railway signals	185
Malta.	Elec. cable	115
,,	Elec. tramway materials	330
Melbourne	.. ..	120
,,	Elec. machinery ..	48
Nagasaki.	Elec. capstans ..	741
New York	.. ..	286
Ostend	.. ..	16
Paris	.. ..	93
Perth	.. ..	65
,,	Elec. cable	2,023
Port Darwin.	Elec. instruments	17
Port Elizabeth	.. .. ..	203
,,	Teleg. wire ..	181
Rio Janeiro	.. .. ..	65
Rotterdam	.. .. ..	50
St. Petersburg	.. .. ..	109
Singapore	.. .. ..	846
Stockholm.	Teleg. mat. ..	10
Sydney	.. ..	929
,,	Elec. machinery ..	200
Tientsin	.. ..	798
Tokio	.. ..	186
,,	Elec. machinery ..	1,376
,,	Elec. cable	3,649
Toronto	.. ..	25
Vancouver	.. ..	25
Vera Cruz	.. ..	35
Wellington	.. ..	679
,,	Elec. machinery. .	60
Yokohama	.. ..	68
,,	Telph. cable. . ..	224
Total	..	£24,999

Foreign Goods Transhipped.

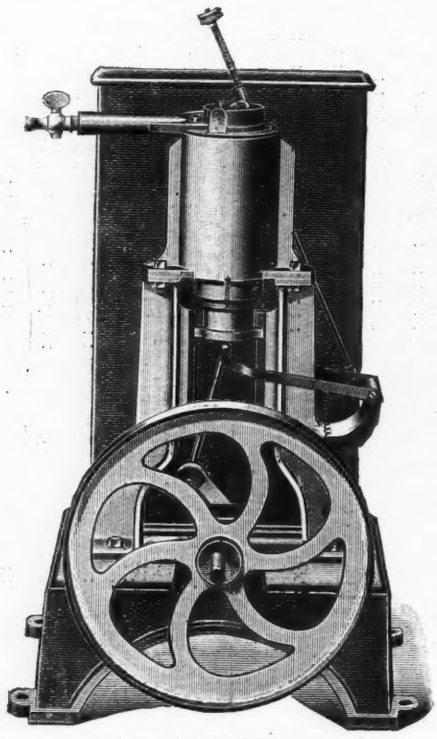
East London.	Elec. appar.	Value £60
Perth.	Elec. machinery ..	346
Total	.. ..	£406
Adelaide.	Elec. appar. .	Value £26
Barbadoes.	Elec. goods ..	47
Total	.. ..	£73

The Advance in Rubber Prices.—The principal causes of the unfavourable condition of the rubber-ware industry are attributed to over production, and the disproportion between the prices of raw materials and of manufactures. In this connection the representative of an interested firm, in the course of an interview reported by the Berlin *Tageblatt*, points out that Para rubber, which has uninterruptedly advanced from 2s. 10d. per lb. at the beginning of 1903, has now actually reached 5s. per lb. It has, however, been impossible for manufacturers to follow this large increase, and out of 57 members of the Association of German Rubber Manufacturers, only 11 are at present in favour of making a further advance in prices. The large works are seeking to utilise their machinery to the fullest extent in order to reduce the cost, and thus over production ensues, to the detriment of the smaller establishments which, it is said, the former are seeking to squeeze out of existence. In addition to this the concentration which has taken place in the electrical industry, has induced the large works, which have established their own rubber factories, to supply their subsidiary companies, while the largest electrical concern in Germany is actually reported to be offering products of its rubber factory to general consumers.

Annual Dinner.—Messrs. Drake & Gorham, Ltd., held their annual cricket dinner at Victoria Mansions Restaurant on the 2nd inst. The chair was taken by Mr. Bernard Drake, who was supported by Mr. Gorham, Mr. Forster, and Mr. Story, directors of the company. The honorary secretary and treasurer reported that 21 matches had been played—11 won, 5 lost, and 5 drawn. The club had also competed for the Baroness Burdett-Coutts Cup, and secured second place. The chairman congratulated the Manchester office on having been able to defeat the head office both in London and at Manchester.

Bankruptcy Proceedings.—A receiving order was made on November 5th in the case of A. J. Hollington, electrical engineer, of Woodford Green, late of Walbrook, on debtor's own petition.

The "Lowne" Patent Atmospheric Engine.—Messrs. Hardy & Padmore, Ltd., of Worcester, have introduced a novel type of heat engine, which is somewhat reminiscent of the old Newcomen steam engine, in that it works by atmospheric pressure. The engine is extremely simple, both in construction and in operation, and absolutely safe. The action is as follows:—For about half the outstroke of the piston, the flame of burning gas is drawn into the cylinder through a valve; the valve then closes, and by the time the outstroke is completed the flame has burnt out. Rapid cooling follows, under the influence of a water jacket, and a partial vacuum is created in the cylinder, so that the piston is forced



The "Lowne" Engine.

inwards by atmospheric pressure. Thus power is developed on each instroke, the vacuum attaining as high a value as 6 lbs. per sq. in. An engine of the pattern illustrated (size No. 2) develops up to $\frac{1}{10}$-H.P., and weighs 32 lbs.; larger sizes are made, up to $\frac{3}{4}$-H.P. Thanks to the simplicity of the machine, no technical knowledge is required to run it; there is an impulse every revolution, and the speed can be controlled by a tap on the gas main at any distance. There are no explosions, and the engine starts at once (it runs in either direction with equal facility). It is suggested that this type of engine is well adapted for use in small domestic applications, such as driving small dynamos, sewing machines, lathes, &c.

Hart Batteries.—The Hart Accumulator Co., Ltd., has secured the contract for the supply of a storage battery, consisting of 278 of its standard central station type cells, required for the electric lighting of Northwood, Uxbridge.

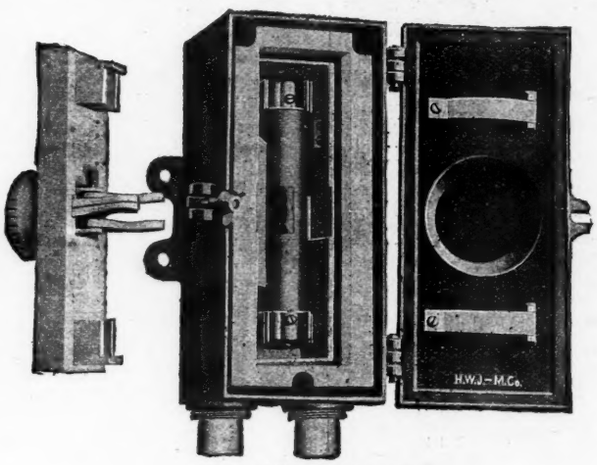
Germany.—The Deutsche Kabelwerke Gesellschaft, of Berlin, reports a profit of £3,900 for the last financial year. A dividend of 3 per cent. is being declared.

Long-lived Railway Motor.—Mr. James Anderson, manager of the Sandwich, Windsor and Amherstburg Railway, Windsor, Ontario, has reported a remarkable life record of a Westinghouse 12-A railway motor under his charge. It has been in constant operation for a period of eight years, covering during that time a distance of, approximately, 450,000 miles; and the repairs have been confined to the replacement of brushes, re-metalling of bearings, and turning up of the commutator. The armature and field coils are intact, but the commutator has been reduced $\frac{3}{8}$ in. by trueing up. The wearing depth of the segments is $\frac{3}{4}$ in., so that if the winding holds out, the motor may last another eight years, and double its already remarkable mileage. We understand that there are several other motors of the same type working on this line that hold very nearly the same record and have been equally free from serious repairs. They are all operated in single equipment, and under 18-ft. cars, and as the road is practically level and without sharp curves, the conditions are somewhat favourable.

For Sale.—An established manufacturing electrical engineering business in Manchester is offered for sale as a going concern.

Messrs. W. Dew & Son will, on November 18th, offer the electric lighting installation, electric fittings, &c., at Anglesey Castle for sale by auction. See our advertisement pages to-day.

New Line Fuse Box.—The British Johns-Manville Co., Ltd., of 81, Fenchurch Street, E.C., are introducing a new weatherproof line fuse-box, the Sachs "Noark," for use on 2,500-volt distributing systems. In designing this box, the first consideration has been to obtain maximum insulation for the current-carrying parts, and also to protect the insulation from weather conditions. The external casing consists of a cast-iron box having a hinged cover opening sideways. The cover is provided with a rubber gasket, which forms a weather-seal between the box proper and the cover, the latter being firmly held in position by the thumb-nut hasp. Inside the iron box is a porcelain box provided with a porcelain cover and fuse holder. When in place, the cover is flush with the top surface of the porcelain box, and finds a seat on a rubber gasket placed in a ledge around the inside of the outer walls of the porcelain box. The enclosed fuse is held to the cover by means of the "lobster claw" device, which consists of a pair of tongs of insulating material, manipulated so as to clamp or release the fuse by means of a nut embedded in the porcelain handle, on the exterior of the cover. When clamped to the cover, the fuse and cover are manipulated as one device and form practically a plug co-acting with the contacts attached to the base portion of the porcelain box. The fuses are fitted with type "C" contacts, which consist of flat blades on each side of the fuse tube, forming a knife-blade switch contact. The receiving clips on the base of the porcelain box are made of



Sachs "Noark" Fuse-Box.

spring metal, and the insertion of the fuse into them is readily accomplished. The arrangement is such that the box is practically closed just before the fuse reaches the contact clips. The wires enter the box through porcelain bushings at the bottom of the iron casing. These porcelain bushings are held in position by means of brass rings, which force the head of the porcelain against the bottom of the porcelain box with a rubber gasket intervening. A watertight joint is therefore made. After the wire once enters the porcelain bushing on the bottom of the box it is entirely surrounded by porcelain. Not only is the box protected from weather conditions by the gasket on the iron cover, but the rubber gasket on the porcelain box, under the porcelain cover, forms a second seal against moisture. When the outer cover is closed and locked in position by the hasp, it firmly presses the porcelain cover against its gasket. An air space is provided around the entire porcelain box, so that in order to leak, the current must creep from the contact part on the inside of the box up over the edge, and around the outside wall. The illustration shows the box with the iron cover open and the porcelain cover removed. In manipulating the device the iron cover is opened. For inspection it is merely necessary to turn the porcelain knob so as to release the claws, after which the porcelain cover may be removed without removing the fuse. Should it be desired to remove the fuse, the porcelain cover is placed in position and the knob manipulated to clamp the fuse. The cover may then be withdrawn again with the fuse clamped thereto.

Theatre "Dimmer."—The first portion yet exhibited of the electrical apparatus to be used in Mr. Maskelyne's remarkable production of "The Coming Race," at his new theatre, was shown this week by Messrs. J. Defries & Sons, Ltd., at their works in Houndsditch. It consists of an invention for reducing the power of the lights in each separate part of the stage and auditorium, and is entirely new in this country. The novelty of the apparatus lies in the fact that the resistances, which hitherto have been made in a large number of pieces, connected together by separate joints, and sometimes embedded in enamel, are constructed out of a single jointless ribbon of metal, wound into as many coils as the number of gradations of brilliancy that are required (in the present case 50). Every turn of these coils is insulated with flake mica, and the whole series of them is arranged between mica disks, which are encased between pressed steel plates. The ribbon, which is in some cases as much as 50 ft. long, is continuously tapered from end to end, and varies the light by quite imperceptible gradations. The Maskelyne installation includes 27 of these dimmers for the control of the fixed lights, in addition to others for regulating the movable arc lamps which illuminate special points.

Crypto Repulsion Motor.—We have received from the Crypto Electrical Co., of 3, Tyers Gateway, Bermondsey Street, S.E., particulars of their new single-phase motors of the induction and repulsion types respectively. The induction motors are made self-starting and self-contained; on top of the motor is fixed a tumbler switch and a push-button, the former of which is closed, and the button pressed until the rotor approaches full speed, when

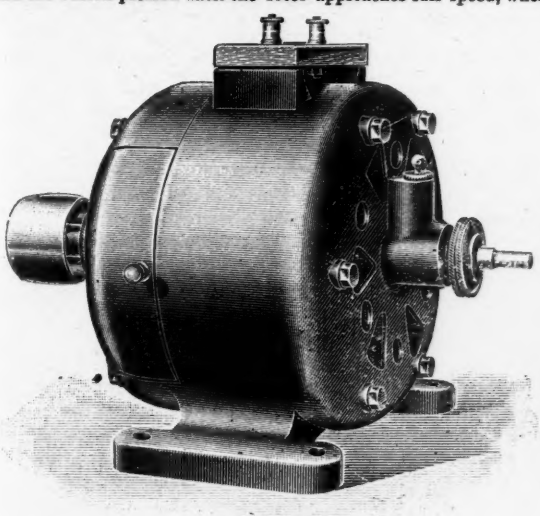


Fig. 1.—Crypto Repulsion Motor.

it is released. These motors are wound for a speed of 1,400 r.p.m. at a frequency of 50 cycles per second. The repulsion motor is illustrated in fig. 1, and is provided with a special winding, which gives a more uniform speed under varying load than the ordinary type. The commutation is quite satisfactory with gauze brushes, and the starting torque with full load current is nearly twice the full load torque. The motor can be provided with a lever to vary the speed by moving the brushes, or the speed can be regulated with a choking coil.

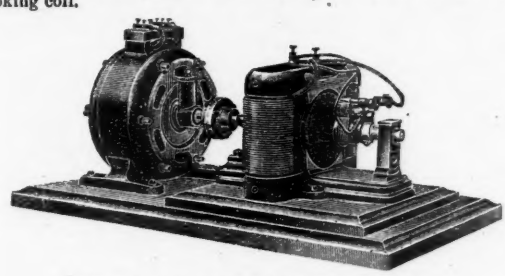


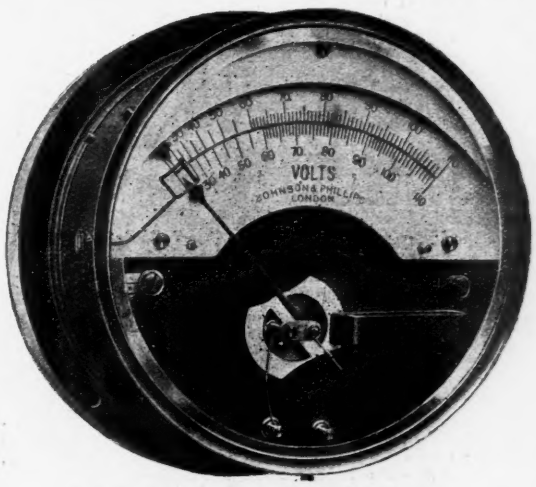
Fig. 2.—A.C. to D.C. Motor-generator.

The company also make a little motor-generator, shown in fig. 2, to convert A.C. derived from the supply mains to D.C. for charging accumulators, &c.

Micanite Patents.—We are informed that the Supreme Court of Germany has by its judgement of November 5th, 1904, confirmed the validity of the German patent No. 73,830, the property of the Mica Insulator Co, Ltd., of the Empire Works, Walthamstow, for the manufacture of micanite plates, and has dismissed with costs the appeal of Meirowsky & Co., of Cologne, for the withdrawal of this patent. A few weeks ago the same company amended their English micanite patents No. 10,430 and No. 6,048.

A Departure in Cast-Iron Tanks.—Recognising the great advantage that would accrue if cast-iron tanks could be supplied from stock, Messrs. Mather & Platt, Ltd., of Queen Anne's Chambers, Westminster, S.W., have laid down a special plant for the production of a series of tank units, of high grade quality, machined true to within one-thousandth part of an inch, from which tanks of almost every size and shape, with flanges either inside or outside, may be constructed. Plates 2 ft. square and 2 ft. 6 in. square are used for the most part, and if the particular tank that it is desired to build cannot be constructed of these alone, other plates of lesser dimensions are used to make up the difference. The flanges are machined right across, and the bolt holes are drilled from the solid at 6 in. centres. These plates are portable, easily handled by one person, and pack closely in cases for transit or shipment. Universal brackets for stay rods are provided, which may be attached wherever required. Outlet or inlet plates, 2 ft. square, are stocked, and these can be placed in any convenient position. The plates being comparatively light, the shape true, and the size exact, the cost of erection is small, and the work can be carried out by any handy man without assistance. The joints are made with ordinary red lead putty, and when finished will be found drop dry and ready for immediate use. We understand that this new departure has already met with considerable success, as engineers are recognising the cheapness and facility with which the tanks can be erected. Large quantities of plates are kept in stock, enabling tanks of almost any dimensions to be delivered immediately. An interesting list with numerous illustrations has been issued, and we venture to believe that those having to do with electricity and traction station practice would find a copy of service.

Differential Hot-Wire Voltmeter.—The accompanying illustration shows the differential hot-wire voltmeter which has been introduced by Messrs. Johnson & Phillips, and is used chiefly for paralleling alternators. The instrument is equally suitable for use with direct and alternating currents of any frequency, and is



J. & P. Differential Hot-Wire Voltmeter.

fitted with two independent movements in one case, one above the other, and two scales on one dial. Thus the pointers are opposite one another and close together, while the instrument occupies no more space than a single voltmeter.

Brush Contracts.—The following are among recent contracts placed with the Brush Electrical Engineering Co., Ltd.:—

New Plymouth Council (New Zealand).—Complete town lighting installation.
Richmond Main Sewerage Board.—Pumping installation.
Paisley Tramways (per Mr. W. M. Murphy).—Four tramcar trucks.

Motor-Driven Compressors.—Messrs. Reavell & Co. report that, owing to the success of their little motor driven central station compressors for cleaning purposes, and the large numbers they have made, they have been able to introduce improvements in manufacture which have reduced the cost, and they are now offering these machines at a considerable reduction in price. For sub-station work also they have introduced a still smaller machine, which they have named the Simplex machine, and which is half the capacity of the Duplex. It is found to be amply large for sub-station work, and is, of course, less expensive than the Duplex. It is made both portable and fixed, and, we understand, has already been successfully introduced into sub-stations.

Dissolutions and Liquidations.—At a meeting of the Sir Hiram Maxim Electrical and Engineering Co., held at Gillingham Street, S.W., on October 31st, voluntary liquidation was resolved upon, with Mr. A. Hardie, Wynstay, Cyprus Road, Finchley, N., as liquidator.

Messrs. W. C. Bersey and C. M. Turrell (Bersey & Turrell, consulting engineers, Dacre House, Arundel Street, Strand) have dissolved partnership. Mr. Turrell will attend to debts, and will carry on the business.

Book Notices.—"A Pocket-book of Electrical Rules and Tables for the use of Electricians and Engineers." By J. Munro and Andrew Jamieson. 17th edition. London: Chas. Griffin and Co. 8s. 6d.

"The *Practical Engineer* Pocket Book for 1905," and "The *Practical Engineer* Electrical Pocket Book for 1905." Manchester: Technical Publishing Co. 1s. net each.

"Fowler's Electrical Engineers' Year Book and Directory of Light, Power, and Traction Stations, 1905." Manchester: Scientific Publishing Co. 1s. 6d. net.

"The Cultivation and Preparation of Para Rubber." By W. H. Johnson, F.L.S. London: Crosby Lockwood & Son. 7s. 6d. net.

"Private House Electric Lighting." By Frederic H. Taylor. London: Percival Marshall & Co. 1s. net.

"Blackie's Handy Book of Logarithms." London: Blackie and Son.

"Australian Mining and Metallurgy." By Donald Clark. Melbourne, Sydney, and Perth: Critchley Parker. London: *Mining Journal*, 46, Queen Victoria Street, E.C. 21s.

Die Elektrischen Anlagen der Schweiz. Vol. 1. "Die Elektrisch Betriebenen Strassen-, Neben-, Berg- und Vollbahnen der Schweiz." By Siegfried Herzog. Zurich: Albert Raustein. M. 18.

"Proceedings of the Physical Society of London." Vol. XIX., Part III. October, 1904. London: Taylor & Francis.

"Electricity in Mining." Nos. 1,128, 1,130, 1,137 and 1,138. Excerpts from the *Transactions* of the Institution of Mining Engineers. Newcastle-on-Tyne: The Secretary, the Institution of Mining Engineers.

St. Louis Awards.—Messrs. Crompton & Co., Ltd., have been awarded a gold medal for their exhibit of electrical measuring instruments; Messrs. Sherard Cowper-Coles & Co., Ltd., have received two gold medals for their exhibit at the St. Louis Exhibition, one for electro-chemistry, and the other for metallurgy. Messrs. Kelvin & James White, Ltd., have been awarded a gold medal for the various electrical measuring instruments, both for switchboard, test room, and laboratory use, exhibited by them in the British Section. Messrs. Everett, Edgcumbe & Co., of Great Saffron Hill, E.C., have been awarded a gold medal for their exhibit. Mr. R. W. Paul, of London, has also been awarded a gold medal in Class 71 (electrical instruments). A gold medal has also been awarded to the Synchronome Co. for the Hope-Jones system of electric clocks. We shall give a full list of the British awards in our next issue.

Trade Announcements. — The Standard Metal Engraving Co., of 93 and 94, Chancery Lane, W.C., are manufacturing a new style of engraved metal name-plate, which is specially adaptable for electrical egineering purposes, such as switchboards, dynamos, &c.

Messrs. Barry, Head & Co., of 26, Lombard Street, E.C., have been appointed sole London agents to the Denby Iron and Coal Co., Ltd.

The Rhodes Electrical Manufacturing Co., Ltd., inform us that they have appointed Mr. Vincent E. Walters, of 45, Newhall Street, Birmingham, as their sole agent for Birmingham and district.

Catalogues and Lists.—The Electrical Co., Ltd., of 121—125, Charing Cross Road, W.C., have sent us leaflets No. 93, relating to their hand-drilling machines for direct, alternating and polyphase currents; No. 97, relating to their E.C. contact clocks for operating two-rate meters of any make; and No. 98, of their small motors for driving sewing machines on D.C. or A.C. circuits.

We have received from Mr. J. F. Smith, of 84, Floyer Road, Small Heath, Birmingham, booklets dealing with his patent conduit for electric tramways, and his patent system of electrical fittings, for dispensing with much of the wiring to switches.

An interesting catalogue of "Ever Ready" electric specialities has come to hand from the American Electrical Novelty and Manufacturing Co., Ltd., of Charing Cross Road, W.C. A variety of carriage, cycle, dental, medical, photographic, reading and other portable lamps are shown and priced.

List No. 176 issued by the British Thomson-Houston Co., Ltd., particularises their continuous-current series-multiple lamps. An index to pamphlets issued to October, 1904, has also been published.

Mr. Albert C. Hands, of 30, Snow Hill, E.C., has just issued a 52-page list, giving various designs of electroliers, wall brackets, table and floor lamps, which are supplied by him in polished brass, hand-wrought finished in antique copper, or brass, or oxidised silver. Prices are given in all cases. Some outside lighting brackets, billiard pendants, also a variety of silk and glass shades are shown.

Bulletin No. 8 of the Brush Electrical Engineering Co., Ltd., gives a large quantity of data—descriptive and tabulated—relating to the Brush open E.O.G. direct-current generators, and the semi-enclosed E.G. direct-current generators. The speeds and outputs, prices, weights, code-words, and various other particulars are well set out for easy reference. Some excellent views of the generators are given in Brush bulletin style.

Messrs. Crompton & Co., Ltd., of Salisbury House, London Wall, E.C., have sent us an advance proof of their forthcoming pamphlet, describing the construction of their new types of moving coil instruments, which can be easily verified and adjusted by the user; we shall refer to this more fully in a later issue.

We have before us a new catalogue (No. 133) of electrical testing instruments which has been issued by Mr. Robert W. Paul, of 68, High Holborn, W.C. It gives particulars and many views of new patterns of instruments which have been introduced by Mr. Paul, including single-pivot milli-voltmeters, direct reading insulation meters, improved mains testing set, high insulation testing switches, micro-galvanometers, and Callender's cable calculator. This circular is supplementary to Catalogue E 17 which was previously in the hands of the trade.

An illustrated catalogue of steel wire brushes has come to hand from the New Anglo-American Machine Brush Syndicate, 31, Wool Exchange, E.C.; also a leaflet showing some new models of brooms for engineers and brass and iron founders. The company has a new catalogue of tube brushes for water-tube boilers now in the Press.

LIGHTING AND POWER NOTES.

Altrincham.—The U.D.C., which has under consideration a proposal to purchase the Altrincham Gas Co.'s undertaking, at a cost of £205,000, has passed a resolution in favour of asking the Altrincham Electric Supply Co. on what terms it would be disposed to sell its concern to the Council.

Aston.—A summons was issued by the Corporation against a consumer recently for non-payment of his account for £3 2s. The town clerk stated that the difficulty had arisen from the fact that the figures registered by the meter ought to have been multiplied by four, and it was to be regretted that the department did not inform consumers of this when taking up a supply. To meet the difficulty, a reduction on accounts of 25 per cent. was made. The defendant was ordered to pay £1 16s. 6d.

Australia.—The *Australian Mining Standard* states that the official starting of the electric plant recently installed at the Cathcart Proprietary Gold Mines, Dennicull Creek, Victoria, took place in September last. While there are several mining companies in Victoria which partially employ electric power for hoisting, hauling and lighting, the Cathcart Co. is the first to adopt electric motive power for all mining operations. The plant installed includes return tube, dry back Otis boilers, working at a pressure of 130 lbs. per sq. in., and a Belliss vertical enclosed compound condensing engine of 170 B.H.P., directly coupled to a Ganz three-phase generator.

The plant is designed to do the work of winding, pumping, puddling, and lighting, and for the former a double-drum winding machine of special design, geared to an electric motor, has been installed. This machine has an average lifting capacity of 800 tons in 24 hours. The pumping plant includes a vertical triplex plunger pump by the Austral Otis Co., of 30,000 gallons per hour capacity, against a head of 215 ft. The pump will run at a constant speed, and if the quantity of water to be lifted is less than 30,000 gallons per hour, one or two plungers will be thrown out of action. For driving the puddlers a three-phase motor is provided, this being the first mine in Victoria to adopt electric driving for that purpose. The contractors for the above plant are the Austral Otis Engineering Co., Ltd., South Melbourne. The condensing plant consists of a Nicholas patent corrugated surface condenser of the latest pattern, and was supplied by a Melbourne firm.

Mr. Edward Noyes, of Messrs. Noyes Bros., electrical engineers, was examined recently by the South Australian Royal Commission respecting the electrical equipment of the Islington Railway workshops. The scheme, he stated, would embrace boilers, generating plant, switchboard, cranes, motors for driving machines, installation, and power house. In answer to questions, he said that from observations an electrical drive would probably pay interest on capital outlay, and sufficient extra to wipe out the cost of the plant in about 10 years. It would mean a big expenditure at the start. Thirty-six motors, 13 crane equipments, and three sets of boilers were required at the works. The present system involved losses in connection with belting and shafting of upwards of 20 per cent.

Sydney.—The E.L. Committee of the City Council has decided to recommend the borrowing of an additional £250,000 to complete the electricity scheme. The Council has also decided to light the Queen Victoria Markets by electricity, at a cost of £900.

Barton.—The Lancashire Electricity Supply Co. has informed the R.D.C. that it intends to apply to the B. of T. for a prov. order to supply energy for motive purposes throughout the Council's area.

Bedwellty.—The B. of G. has resolved to install the electric light at the workhouse at an estimated cost of £2,000, and Messrs. H. Lewis & Fletcher, of Cardiff, have been appointed consulting engineers.

Belfast.—The recommendation of the joint meeting of the Gas, Electric and Tramways Committees, relative to the transfer of the electric lighting undertaking from the Gas and Electric to the Tramways Committee, has been approved by the T.C.

Bootle.—At the local Police Court last week, two boys were summoned for damaging an electric fuse box, belonging to the Bootle Corporation. It was stated that on October 7th, about the middle of the day, the defendants were seen to put a wire into a fuse-box, the effect of which was a total derangement of the electrical apparatus of the borough, and at several large works where the electric light was in use much inconvenience was experienced. One of the defendants said he put the wire into the box in order to get an electric shock. The chairman said the boys had indulged in a very dangerous practice, and ordered them to pay the cost of the summons.

Brentwood.—The U.D.C. has decided not to offer any opposition to private companies seeking powers to supply electricity in the town.

Burgess Hill.—In response to inquiries from the B. of T., the U.D.C. has replied with reference to the E.L. order of 1901 that it has formulated a scheme and obtained tenders for the works, but in consequence of the large amount of capital expenditure involved and the present state of the money market, no further progress has been made, and it has asked the B. of T. to allow the order to remain in force.

Cardiff.—On the representation of the electrical engineer, the Lighting Committee has resolved to ask the Council to sanction an application to the L.G.B. for power to borrow £87,000 for further extensions. Mr. A. Ellis stated that it had been necessary to issue a notice that fresh consumers could not be connected, and that the additional orders for next year totalled an equivalent of 46,000 lamps.

Castleford.—The U.D.C. has resolved to apply for an extension of time for carrying out the E.L. order.

Cheltenham.—Mr. James Swinburne, of London, who was called in by the Corporation to report on the working of the electrical undertaking, has forwarded his report. He points out that Cheltenham is spread over a large area in proportion to its population, and that private houses in their own grounds, although most profitable customers, are spread over a large area. The public street lighting is also carried out in a more elaborate way than usual

Dealing in the first place with the accounts, he finds that depreciation should be charged in the case of a municipal undertaking, but that, other things being equal, it should be less than a private concern's depreciation by the amount of the repayment. In practice, the case is much more complicated by the borrowing of more money before the original loan is paid off, for necessary extensions of plant, &c. The obvious way of keeping matters straight, he thinks, is to pay off the first loan when taking up the second. But this method is not adopted, and so the capital accounts become a tangle of loans redeemable at different dates, at all sorts of rates of interest, and having no traceable relation to the plant actually in existence. At Cheltenham, plant has been discarded, although sinking fund is still being paid in respect of it. He makes the following suggestions as to the accounts:—(1) That the interest and sinking fund should be charged as usual; (2) that a depreciation and antiquation fund on the present value of the plant, &c., be charged at a percentage rate that would be charged in private concerns, less the percentage rate for the sinking fund, repairs, and other maintenance charges to come out of this fund; (3) that a rent should be charged for the works, such as the Council would have obtained had they let the ground; (4) properly speaking, the works should be charged with the same rates as they would have paid had they been a private concern.

As regards distribution, the main cause of the present position of the undertaking is, that it has been managed too much with a view to a rosy future rather than a matter of fact present. As an instance, he says, the supply of energy was commenced about May, 1895, from works costing £16,800, but in July of the same year it was decided to apply for a loan of £10,000 for extension, and in February of the following year for a further loan of £15,000. It would have been prudent to have accepted the view expressed in Mr. Hall's report until there were distinct indications that the undertaking would pay. Mains have been extended in a way which pointed to a complete absence of consideration of their probable revenue. Expensive outlying consumers appear to have obtained the light on the same terms as those in the compulsory area. This must have been a source of loss. The result is that the system of mains in Cheltenham is a sort of skeleton with very little on it.

Dealing with the public lighting, he points out that the 37 arc lamps in 1898 have been increased to 388 in the present year, and it appears to him that a town of 50,000 inhabitants can hardly afford to spend the £6,698 allocated to public lighting in the accounts of 1903-4, to say nothing of the larger sum of £8,610 necessary to make the undertaking pay expenses. From an engineering point of view, the arc lighting is carried on satisfactorily.

The price charged for energy supplied to the tramway (a private undertaking) is too low, and might be raised without approaching too nearly the cost of generating by the tramway company themselves. Apart from the question of policy in the rapid extension of mains, sub-stations to deal with a much larger future consumption, and the arc lighting, the engineering has been carried out well, and certain plant has been discarded for adequate reasons.

In reference to the future, he suggests that a system of energetic house-to-house canvass for customers be put in hand, and particularly in the streets which already have mains. As to street lighting, he recommends that Nernst lamps be put on the present arc lamp standards.

Chertsey.—The U.D.C. has decided to withdraw its opposition to the application of the Woking Electric Supply Co. for an extension of its area, so as to include Chertsey in the area of supply. At the same time the Council will oppose other schemes for E.L. in the district at the expense of the company.

The B. of T. has informed the Council that the Staines and Egham E.L. order has been revoked.

Christchurch, N.Z.—We have received from Mr. Lawrence Birks, the city electrical engineer, the results for the first financial year's working (eight months only) ended March 31st last, and also the results for the 12 complete months' running, the works being inaugurated on August 1st, 1903:—

	8 months.	12 months.
Revenue, practically all from private supply ..	£945	£2,136
Total working costs	£565	£933
Depreciation	£485	—
Interest	£317	—
Deficit	£395	—
Total working costs per unit	3·41d.	2·24d.
Average price obtained per unit	5·75d.	5·13d.
Number of units sold	39,423	99,936
Maximum load recorded	92 KW.	—
Total capital expended	£12,142	—

The prices charged previous to July last were 10d. to 5d. per unit for lighting, and 3d. to 1d. for power, but these have since been reduced. The total number of consumers connected up to August last amounted to 113. There is no public lighting. The plant is worked in conjunction with a refuse destructor, and has a capacity of 200 KW., and the maximum load so far recorded is 104 KW.; a third generating set is to be put down.

Colchester.—A L.G.B. inquiry was held recently into the Corporation's application for a loan of £16,500 for E.L. purposes, viz., the provision of two 550-H.P. engines, dynamos, boilers, and the necessary piping, and condensing and water-softening plant. There was no opposition.

Dublin.—At a meeting of the City Council on 7th inst., the following communication from Mr. Robert Hammond, on the subject of supervising the working of the electrical undertaking, was considered:—

"Gentlemen,—1. I understand that my letter of August 25th last, reporting the result of my 12 months' supervision and making an offer in reference to further supervision of the working of the electrical undertaking of the city, will be considered at the meeting of the City Council on Monday next.

"2. In the course of the recent Local Government Board inquiry, I gathered that my offers to supervise the working of the undertaking were much misunderstood, and I therefore take the opportunity of making matters somewhat clearer.

"3. It is well known to the members of the Municipal Council that from the inception of the undertaking, up to the present time, my scheme has been subjected to a large amount of adverse criticism.

"4. It has been stated over and over again that the estimates made by me of the probable financial results of my original scheme contained in my report of December 7th, 1899, are unreliable and far too optimistic.

"5. Under these circumstances it seemed to me proper, in turning the concern over to the Corporation, to offer to guarantee to the Corporation the results set forth in my original report.

"6. The figure which has been most frequently assailed is my estimate, that the cost of generating and delivering electrical energy in Dublin, exclusive of capital charges, would not exceed 1½d. per unit.

"7. This figure having been derided, I made the offer in my letter of August 25th, which offer I now repeat, to enter into an arrangement with the Municipal Council for the supervision of the working of the undertaking during a period of seven years, guaranteeing the cost of 1½d. per unit, my remuneration for my supervision and for my guarantee being the difference between 1½d. per unit and the lowest figure at which I may be able to generate and distribute.

"8. In view of my evidence at the recent Local Government Board inquiry, in reference to decreased costs, consequent upon the continued great progress of the new system, I am willing to make my offer even more favourable. I stated before the inspector that I estimated that an increased output of 320,000 units beyond the output named in my original report could be generated and distributed at 1½d. per unit, and an increase of 880,000 units at 1d. per unit.

"9. Under these circumstances I beg to express my willingness, in the event of the Corporation giving me the supervision of the undertaking for seven years, to guarantee the Corporation the lower prices named in my evidence.

"10. I desire the special attention of the members of the Council to the fact that my proposal is to charge the Corporation not for units generated, but for units actually delivered to the consumers, and to the public lighting circuits, and that when the output had reached 3,520,000 units the costs to the Corporation of generation and distribution would be as follows:—

	Units.
Output per my original report, which included the consumption by 500 public lamps	2,645,000 at 1½d.
Output per my recent evidence	880,000 at 1d.
Total output	3,525,000

Average cost, 1·375d. per unit.

"11. The members of the Municipal Council are, however, aware that, as an alternative proposition, I offered in my letter of August 25th last, to take over the working of the electricity undertaking for a period of not less than fourteen years, on the basis of my relieving the Corporation of all responsibility for the capital charges during that period.

"12. At the recent inquiry the opponents of the Corporation undertaking urged that some years would elapse before the profits would be sufficient to pay the capital charges upon the capital outlay. Under my proposition the city would be entirely relieved from the payment of those capital charges during the heavier repayment period.

"13. I need hardly remind you that if the business be not so successful as I anticipate it will be, my offer would mean a heavy financial loss to me, while the Corporation would not only avoid this loss but would also benefit by the fact that the loan is based upon the instalment plan under which the rates of repayments of capital decrease each year. I may point out that on the original loan the first year's instalments amount to about £6 7s. per cent., the fourteenth year's instalments to about £5 1s. per cent., the twenty-first to about £4 7s. per cent., and the thirty-fifth to about £2 19s. per cent.

"14. With regard to the rates of charge to consumers, I should, of course, be prepared to agree that in no case should the present rates be increased, and, indeed, I should go further and ask for the power of lowering the rates. My experience convinces me that low rates are essential to the development of an electricity undertaking on sound and profitable lines.

"15. An objection has been urged that the City of Dublin should not part with its undertaking, and I desire to state that I entirely agree with those who hold that opinion, though, in view of the hostile criticism which appears to be as virulent to-day as it was five years ago, I think it my duty to give a substantial proof to the Municipal Council that the optimism, for which I have been blamed, has a solid business foundation, while at the same time I may add that my offer is the outcome of my confidence in the financial prospects of the undertaking.

"16. In reply to those who have derided my offers as being such as should not have been made by an advocate of municipal ownership, I beg to say that it is not my proposition that the Corporation of Dublin should part with their property, which I feel certain will prove most profitable to the city, but simply that they should place in my hands the responsibility of working the undertaking for a limited number of years.

"17. At the recent Local Government Board inquiry it was suggested that under this arrangement the plant would be handed back to the Corporation in the form of 'scrap,' and as an answer to this criticism, I desire to state that a guarantee would be given that the plant would be properly maintained during the whole period, as, indeed, it must necessarily be maintained in order to afford the efficient and continuous supply of electrical energy required by the Board of Trade regulations under which the undertaking is worked. A guarantee would also be given that the plant would be handed back to the Corporation in proper working order.

"18. If the Municipal Council prefer that the arrangement should be for 21 years, I should be equally agreeable.

"19. It has been pointed out that such an arrangement would take away from the Municipal Council for some years all chance of giving the ratepayers the benefit of any profits that might arise from the working of the electrical undertaking. On this point I desire to state that if the Municipal Council decide to consider my offer favourably I shall be willing to amend it to the extent of giving the Corporation half the profits after a payment of a fair fee to cover supervision, guarantee, &c.

"20. In the event of either of my offers being accepted, I should be prepared to deposit in the hands of the Corporation securities of a reasonable amount, which would be subject to forfeit in the event of the guarantees not being fulfilled.

"21. May I point out that the favourable consideration of my offers would in no way interfere with my responsibilities and duties as consulting engineer to the Corporation.

"22. In conclusion, I may add that if after consideration of my offers the Municipal Council decide that the citizens may well take the risk of the future profitable working of the undertaking, such decision will give me great satisfaction, and it will be my endeavour, as long as I am honoured with the continued confidence of the Corporation, to do my work in such a manner as will prove of the greatest benefit to the city.

"I am, yours faithfully,
"ROBERT HAMMOND."

Ultimately, it was resolved to refer the consideration of the matter to a committee of the whole house.

Ealing.—A L.G.B. inquiry was held recently with respect to an application by the T.C. for sanction to a proposed loan of £20,000—£11,000 for additions to the electric lighting plant, and £9,000 for mains.

Edmonton. — The District Council had before it on Tuesday last offers from the following firms for the execution and maintenance of electricity works under the Council's provisional order: North Metropolitan Electric Power Supply Co., Ltd., Foote & Milne, Ltd., Westminster, the Industrial Engineering Co., Newton Ironworks, near Hyde, and the National Electric Construction Co., Ltd. The first-named company's proposals were based upon a scheme under which it would provide all the capital to be expended on the undertaking, and work it, and refund the costs incurred by the Council in obtaining the order and the consulting engineer's fees amounting, to date, to £2,800. The company did not propose to provide a separate generating station, but would give a supply from one of its existing power stations. It would agree to the undertaking being purchased at the expiration of 26 years, or any subsequent period of seven years at a valuation. At the end of 26 years it was proposed to divide the net profits equally with the Council, after it had had 5 per cent. upon the whole of the capital involved. The offers from the other three firms were based upon a scheme under which the Council would provide the capital to be expended. Foote & Milne, Ltd., and the National Construction Co. were each willing to maintain the undertaking for 25 years. They were prepared to have the agreement determined at the expiration of 15 years without the payment of compensation. The Industrial Engineering Co. was prepared to maintain the undertaking for five years, the agreement to be determined at any time within that period upon the payment of such a sum as would bring up the profits to an amount equal to 3 per cent. per annum over and above the sinking fund and interest paid to the Council. After some discussion, the Council agreed to hold a special meeting to consider whether one of the tenders should be accepted, or whether a municipal undertaking should be established.

Egypt.—The Société Electrique de la Basse Egypte is in negotiation with the Prisons Department for the installation of electric light in Tautah prison.

The town of Suez was recently lighted with electricity for the first time. Port Tewfik will be similarly lighted shortly.

Gillingham. — The T.C. has agreed with Messrs. Witting, Eborall & Co., Ltd., regarding the supply of motors to consumers on hire.

Hipperholme.—The U.D.C. has decided to apply for a prov. order for E.L.

India.—A second application has been made to utilise the Naini Tal lake water for generating electricity for Naini Tal, but says *Indian Engineering*, the circumstances of a hydro-electric project for this hill station were gone into in detail quite recently, and the scheme was not considered practicable owing to the heavy cost that would be entailed, and the many unfavourable local circumstances.

Jamaica.—The Portland Parochial Board has agreed to the terms of the E.L. licensees for lighting the streets of Port Antonio. Fifty lights are to be erected, and the company is to receive £4 15s. per annum for each for all-night service, and £3 5s. for half-night service, and is to install and maintain the same at its own expense.

Kent Electric Power Co.—The Sevenoaks U.D.C. has consented to six months' extension of time for making the deposit in relation to the transfer of the E.L. order, 1903. The Sittingbourne U.D.C. has declined to give consent to a similar application by the same company.

Knutsford.—The U.D.C. has definitely decided to offer its E.L. order for sale, and negotiations are proceeding with a Haslingden firm with this object in view.

Lancashire Electric Power Co.—This company has given notice of, and has applied for the sanction of the B. of T. to, the breaking up of roads for laying mains, &c., in Radcliffe, Ramsbottom, Kearsley, Little Lever, Farnworth, Hindley, and Abram.

Little Lever.—The *London Gazette* of November 4th contains notice of the U.D.C.'s intended application for a prov. order.

Llangollen.—The undertaking of the Llangollen and District Electric Light and Power Co. was inaugurated on the 4th inst. A banquet was subsequently held at the Royal Hotel in commemoration of this event.

London.—Islington.—The B.C., after considering an application by the Underground Electric Railways Co., Ltd., for a supply of energy for lighting stations within the district, has decided to offer a supply at its lowest rate already authorised for power purposes—*i.e.*, 1½d. per unit, where it can be taken from the existing mains. The company guarantees a load factor of 23 hours per day all the year round.

City.—The Streets Committee is to consider and report upon a letter from the Charing Cross and Strand Electricity Supply Corporation, Ltd., asking for the consent of the civic authority to a change of pressure from 100 volts to 200 volts in the parts of the western area of the City where a supply of 100 volts is now being given.

Finsbury.—The town clerk has been instructed by the B.C. to ask the County of London Electric Supply Co. to abolish the charge for meter rents.

Marylebone.—The Electric Supply Committee of the B.C. reported, on Tuesday, having agreed to the terms of the conditions upon which the L.C.C. is prepared to consent to a proposed change of pressure.

Southwark.—The Metropolitan Borough has given notice that the Committee of the Privy Council, under the London Government Act, 1899, has settled a scheme with reference to the Newington electric lighting undertaking, which provides, *inter alia*, that the expenses of, and the receipts from, that undertaking shall be divided among the several parishes in the borough in proportion to their rateable value. Copies of this scheme may be inspected and obtained at the office of the town clerk.

Lytham.—The U.D.C. has appointed a special Committee to consider the offer of St. Anne's U.D.C. to supply energy in bulk, and also the terms offered by a syndicate who propose to apply for a prov. order for E.L. in the Council's district.

Plymouth.—The T.C. has received from the L.G.B. sanction to raise a loan of £20,000 for E.L. purposes.

Runcorn.—The U.D.C. has sealed an agreement with the Mersey Electric Supply Co. transferring to the latter its E.L. prov. order obtained in 1899.

Spalding.—The U.D.C. has resolved to apply to the B. of T. for a prov. order for E.L., the area of proposed supply including the principal streets of the town.

Stoke-on-Trent.—On the 31st ult. the formal opening of the new electricity and destructor works took place, the Lady Mayoress performing the ceremony. The Corporation proposes to supply energy for private lighting and power purposes only. A site of 6,121 sq. yds. has been utilised for the erection of the buildings, which are designed so as to form two separate undertakings. The main plant consists of two 150-KW. sets. The engines are of Messrs. Willans' enclosed high-speed compound type, direct-coupled to multipolar D.C. generators of 300 amperes at 500 volts. The battery room contains 242 Tudor cells, with a maximum capacity of 350 ampere-hours. About 6 miles of mains have been laid, wooden troughing being used. The refuse destructor consists of two cells, with a total capacity of about 60 tons per day. A special offal-charging hopper and hearth is installed, and provision is made for cremating diseased animals, and a clinker conveyor has also been erected. The distribution of electricity is on the three-wire system, 240 volts between outers. The cost of the whole scheme is about £30,640—£17,840 for the electricity works, and £12,800 for the destructor. The buildings were designed, and the building work and erection of the destructor was carried out by the borough surveyor, and the electrical portion of the work under Mr. P. J. S. Tiddeman, the Council's electrical engineer.

Stockton.—The Corporation E.L. mains are to be extended to Hartburn.

Surbiton.—The *London Gazette* for November 8th contains notice of the application of the U.D.C. for a prov. order.

Willesden.—Mains extensions at an estimated cost of £815 are to be carried out by the U.D.C.

Windsor.—Messrs. Foote & Milne, Ltd., of 66, Victoria Street, S.W., have informed the R.D.C. that they intend to apply for a prov. order for E.L. at Sunninghill and Sunningdale.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—The financial statement for the six months ended September 30th shows a net profit on the working of the Corporation tramways of £230, compared with a loss of £681 in the corresponding period of 1903. The total receipts from all sources was £27,661, equal to 12·34d. per car-mile. The expenditure totalled £16,693, equal to 7·44d. per car-mile. From the gross balance of £10,968, was paid £3,040 instalment of loans, £3,204 to sinking fund, and £4,491 interest on loans. The traffic receipts worked out at an average of 11·85d. per car-mile.

Chatham and Rochester. — The connection of the Chatham and District Light Railway with electric tramways of the city of Rochester is now nearly complete. The junction will be at the Military Road, Chatham, and the end of the New Road, the tramlines passing on through a long avenue of trees into the city. The contract is being carried out by Messrs. Dick, Kerr and Co.

Dudley.—Further correspondence has now taken place between the B.E.T. Co. and the Dudley Corporation in reference to the proposed purchase by the Corporation of the tramways within the borough. No settlement, however, as regards the price has been arrived at, nor is there likely to be a settlement, hence the Tramways Committee recommended the Council to make application to the Board of Trade to appoint an arbitrator as provided for in the draft agreement. By that agreement made in 1889, the Corporation were to purchase the lines from the B.E.T. Co., and then lease them to that company for a term of 21 years. The purchase was to take effect and the lease was to be dated from August, 1903. But although the outlines of the agreement were most amicably settled, the details have been found most difficult of adjustment. Fortunately, however, the terms of the agreement provided against such a difficulty, and the parties are thereby entitled to call upon the Board of Trade to appoint a referee.

Electric Trains v. Trams.—The popularity of the electric trains is becoming more pronounced as the system is elaborated. This applies to the new electric railways both at Southport and Newcastle. In regard to Newcastle, the competition is having a serious effect on the Newcastle Corporation tramways, for, despite the number of extra routes opened, the receipts only average a pound or two more than a year ago, while last week there was a decrease of £100. On the route from Birkdale to Southport and *vice versâ* the Lancashire and Yorkshire Electric Railway is proving a severe competitor to the Southport Tramways Co. The journey is accomplished so much quicker on the railway that many passengers are induced to go by train, even though they may have to wait a few minutes before leaving the station.

London.—The application proposed to be made to Parliament by the L.C.C. in the next session relates to powers to construct a short length of tramway in Norwood, to connect with the Croydon tramways; tramways over Blackfriars Bridge and along the Victoria Embankment to Waterloo Bridge; and power to use electric traction on the authorised tramways over the new Vauxhall Bridge.

The L.C.C. on Tuesday sanctioned an expenditure of £1,000 for the purchase, for the Tramways department, of a covered breakdown motor van, and a motor-car for the chief officer and his principal assistants.

Manchester District.—Application is to be made by the Gorton District Council for a provisional order for the construction of a line of tramways from the Plough Hotel, Hyde Road, along Wellington Street, and Gorton Lane, and another from the Canal Bridge, Hyde Road, along Reddish Lane, to join the Stockport system. The lines will be carried to the boundary of Gorton township in each case. Delay in the construction of tramways in Sale, forming part of the Manchester and Altrincham new route, is occasioned by the necessity of widening Crossford Bridge, over the River Mersey, which divides the counties of Lancaster and Chester. This road is the main artery of communication between the two counties south of Manchester, and the vehicular traffic over it is very great. The Lancashire County Council is being memorialised to undertake the widening of the bridge in the public interest.

New York Subway. — A New York correspondent writes:—"The New York subway was officially opened on Thursday, October 27th, by Mayor G. B. McClellan, who, after a brief ceremony in the City Hall, drove the first train from Brooklyn Bridge to Harlem in the scheduled time of 15 minutes. Between 2 p.m. and 7 fifteen thousand specially invited guests rode on the express and local trains, and at the later hour paying passengers were accepted. Statistics show that 127,000 fares were paid between 7 o'clock and midnight. In the Mayor's party were Bishop Greer, who offered a prayer for the success of the subway. Archbishop Farley, who pronounced a benediction; Mr. Alexander E. Orr, president of the Rapid Transit Commission; Mr. August Belmont, president of the Interborough Rapid Transit Co.; the lessees of the line; Mr. John B. Macdonald, the contractor; Mr. J. B. Frank Hedley, manager of the I.R.T. Co.; and many others representing official and engineering circles. The portion of the subway system opened extends from the City Hall, adjacent to Brooklyn Bridge to 145th Street and Broadway. An extension from the main line from 103rd Street up Lennox Avenue is promised to be opened shortly, and in due time the lower part of the subway from City Hall to South Ferry will be in operation. The latter line will ultimately connect with Brooklyn by means of a tunnel under the East River. The subway is being built at a cost of about $37,000,000. The money has been obtained by an issue of municipal bonds. The line has been leased to the Interborough Rapid Transit Co. for a period of 50 years. With the trains now running as many as 25,000 passengers an hour can be handled, but when the full number of cars is installed double this number can be carried. This enterprise is but the beginning of a number of subway schemes that are under discussion."

Newcastle-upon-Tyne.—At a meeting of the City Council on the 31st ult., the appended letter was read from Mr. A. E. Le Rossignol, the manager of the Corporation tramways:—

8, Victoria Square, Newcastle-upon-Tyne, October 31st, 1904.

To the Mayor, Aldermen and Council of Newcastle-upon-Tyne.

Gentlemen,—At the meeting of Council held on Wednesday last, the 26th day of October, a discussion arose upon the letter which I had asked to be read, and in that discussion Alderman Newton is reported in the Press to have made the following statements:—

1. Horses had been bought and the Committee knew nothing about it.
2. Motor-cars had been bought, also without authority.
3. Cars were built, although they had an ample supply of cars, simply in order to give men in their employment permanent work.
4. The increase in Mr. Le Rossignol's salary was given under misinformation—he might use a stronger word.

Regarding the first statement, on April 26th, 1901, the Committee by minute approved of the plans for the reconstruction of the sheds at Haymarket and Gosforth, these plans showing stables, &c., for horses, and on April 26th instructed me to carry out the work. On May 8th, 1902, the Committee confirmed the special minute of the Finance Sub-Committee of May 7th, 1902, sanctioning the purchase of the first six horses of the stud, and every horse since purchased has been passed in the ordinary way through the pay bill which comes before the Committee of which Alderman Newton is a member.

On October 20th, 1902, the Committee, after a survey of the spot, "instructed the general manager to prepare and submit to them plans for stables at Byker with about four stalls and two loose boxes, a shed in which to keep the tower-repairing wagon and carts," and on November 6th, 1902, instructed me to proceed with the work of construction.

In July, 1903, I reported to the Committee and Council in my annual report that the Tramways Committee then had 15 horses and the necessary carts, vans, and did their own carting work.

In face of this it is idle for Alderman Newton to assert the Committee' ignorance.

As regards the second statement—that motor-cars had been bought, also with out authority, the minute of the Tramways Committee meeting of May 22nd 1902, states:—"It was agreed that the general manager should purchase a small motor-car, to be kept at the power station, in readiness for use of officials." This is the only motor-car the Committee possess, but one motor tower-wagon has been bought by the Committee under their minute of June 12th, 1902.

As regards the third statement—that "Cars were built although they had an ample supply of cars, simply in order to give men who were in their employment permanent work," the minute of the Tramways Committee meeting of July 10th, 1902, states: "The general manager was instructed to submit designs of proposed new cars, and after the design had been approved, to get the 40 additional cars built." Only 20 additional cars were built by me under this minute, and the Committee's minute of May 12th, 1904, instructs me to push on as quickly as possible for race week the construction of the new cars then building. All the cars the Committee at present possess, and perhaps more, will be wanted to maintain a proper service next race week.

As regards the fourth statement—"The increase in Mr. Le Rossignol's salary was given under misinformation—he might use a stronger word," I can only refer to the Council proceedings of January 13th, 1904, and repeat what I stated in my letter to the Council, that "during 1903 I had the heavy work of designing and constructing all the extensions to the power station, pumping station, car works, car-sheds, and lines authorised by the 1902 Act, thereby saving you £4,000, which the city would otherwise have had to pay in fees. For this service the Corporation unanimously granted me an increase of £100 a year in my salary, and I very naturally regarded this increase of salary as evidence of the confidence the members of the Corporation had in me, and also as a tangible proof of the satisfaction which my work had given."

The Council ought to remember that this increase was given after I had been four years in their service.

I think the Council will agree that, as I cannot answer for myself in this chamber to Alderman Newton's inaccurate statements, it is only fair that this denial should have the same publicity as his accusation received.—Yours faithfully,

(Signed) A. E. Le Rossignol.

Ald. Newton said he did not desire to modify anything he had said. On the contrary, he could amplify it very, very much, and introduce new material which would fortify the position he had taken up.

Eventually the letter was referred to the Tramways Committee.

Nottingham.—The Corporation tramways last year made a gross profit of £56,943 9s. 10d., and £13,000 has been granted in relief of the rates.

Wolverhampton.—In the annual report of the Tramways Committee, it is stated that the operation of the Lorain surface-contact system during the last 12 months has been entirely satisfactory, and that it has more than justified its excellent reputation for safety and reliability. The maintenance costs are being reduced, and the Committee have reason to believe that the total working costs of the Wolverhampton Tramways for the present year will be considerably below the average of other towns where the overhead system is installed. The following is a statement showing the receipts, &c., from April 1st to September 30th this year, as compared with the same period last year:—

	Miles run.	Passengers carried.	Receipts.	Receipts per car-mile.
1904	378,152	3,740,722	£18,444	11·706d.
1903	265,904	2,360,904	£12,311	11·112d.
Increase this year ..	112,248	1,379,818	£6,133	·594d.

These figures the Committee state are very satisfactory, and show an increase of ·594d. per car-mile, and the mileage has increased by 112,248. It is also stated that there are now 20 miles of single-track open for service, as against 6½ miles last year. Further, that the staff has increased from 90 to 149. The highest receipts taken in one week were for the August holiday week this year, when they amounted to £1,003 19s. 7½d., or 14·7d. per car-mile. The total number of cars in stock is 30; 10 more being on order and about to be delivered.

(*Continued on page* 791.)

THE STALYBRIDGE, HYDE, MOSSLEY AND DUKINFIELD TRAMWAYS AND ELECTRICITY BOARD'S SCHEME.

The opening of the first section of this scheme was referred to in our issue of May 27th last, when a rough outline of the undertaking, and a plan of the area covered by the operations, were also given.

We then mentioned that as the outcome of a suggestion

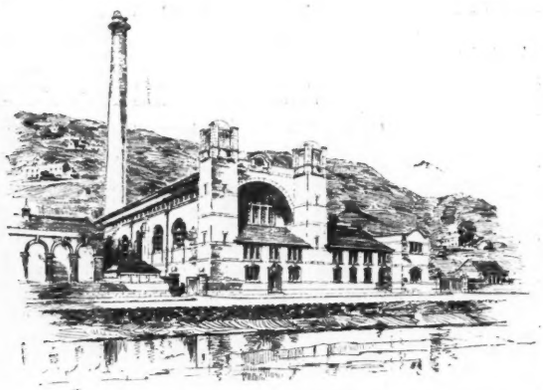


Fig. 1.—View of Generating Station, Stalybridge.

by Alderman J. R. Norman, J.P., of Stalybridge, in 1897, a joint committee was formed to investigate the feasibility of a combined electric supply and tramways undertaking, and that Mr. Alfred H. Gibbings was subsequently selected to report on, and eventually to carry through, as consulting engineer, the scheme which received Parliamentary sanction, under the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Act of 1901.

The scheme which Mr. Gibbings commenced to design in January, 1902, had progressed sufficiently to allow of the first portion being put into operation in May, 1904, since which date the several other sections have been gradually completed.

The area covered by the undertaking lies in the immediate neighbourhood of Manchester, and comprises some very important manufacturing interests, which even if not immediately responsive to the admittedly economic advantages of electricity, municipal or otherwise, for mill

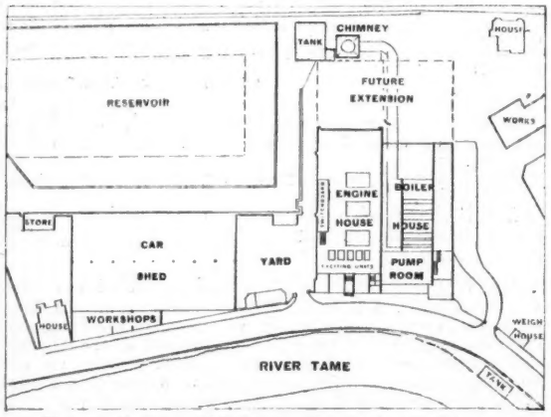


Fig. 3.—Plan of Generating Station and Car-shed, Stalybridge.

driving, may well realise in the near future, what many of their Continental rivals, with greater insight, have comprehended for several years past.

The tramways scheme also is likely to fulfil more functions than that of carrying the local resident to and from his work, when the true relation of suburban tramways to the great intercommunication problem is properly appreciated.

The joint scheme, which may claim the honour of being the first of its kind in Great Britain, comprises a main high-tension generating station, supplying energy at a pressure of 6,000 volts to four sub-stations located in the respective joint districts; from the sub-stations L.T. distribution for light and power is effected on the three-wire system, and the tramway scheme, comprising some 21 miles of route, is supplied with energy.

The main generating station is situated on the boundary of Stalybridge and Dukinfield, and in close proximity to the River Tame. It comprises an engine room 150 ft. long and 63 ft. wide, parallel with which is the boiler house. The end of these buildings fronts on to a main road, and presents a striking appearance architecturally; the other end is of a temporary character to allow for extensions.

Running parallel with the road at one side of the station is a large car depôt, and immediately beside it a reservoir of ample area, which is utilised for water storage in connection with the station condensing plant, for which also the river can be drawn upon.

The boiler-house plant at present consists of six Lancashire boilers, each 8 ft. 6 in. diameter and 30 ft. long, constructed for a working pressure of 180 lbs. per sq. in. These were supplied by Messrs. Tinker, Shenton & Co., Ltd., Hyde, and are provided with two sets of safety valves and other fittings of modern type.

In rear of the boilers are arranged two fuel economisers of Messrs. Goodbrand's make, containing 240 and 360 tubes respectively, 9 ft. long and $4\frac{9}{16}$ in. diameter, and provided with scrapers operated by a 2-H.P. direct current motor.

The arrangement of flues is such that the economisers can be run in series or parallel, or singly, and can be cut out of action in case of necessity. The main flue leads to a circular brick chimney 225 ft. in height at the rear of the buildings.

The main steam pipes are arranged on a horizontal ring

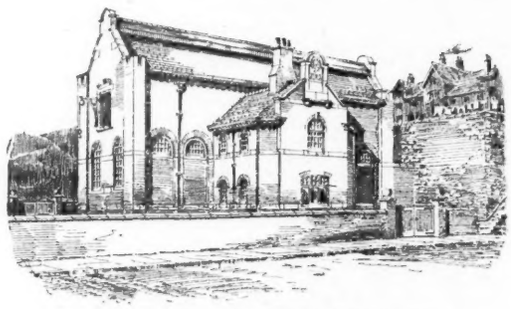


Fig. 2.—View of Sub-station, Stalybridge.

main system in the boiler house, provided with suitable water pockets, and connecting branches from the various boilers and to the several generating units in the engine house. The whole of the steam pipes are of steel, with wrought-iron flanges screwed and brazed on; the boiler branches being fitted with both non-return and stop valves, and the engine branches leading into steam separators in the engine room, from which the engine connections are taken.

It will be noted that the firing floor (fig. 6) is divided off from the remainder of the boiler house and that the boilers are hand-fired, fuel being tipped into the building from the yard; machine stoking is, however, arranged for the future. The present boiler house is sufficiently large to accommodate three more boilers when required.

The pump room is situated at one end of the boiler house, and contains three vertical tandem-compound steam-driven pumps, having a rated capacity of 3,000 gallons per hour, and supplied by Messrs. J. P. Hall & Sons, of Peterborough. These pumps draw from hot wells situated under the pump room floor or from the town supply, and deliver through two Watson filters and two Kennedy meters, the delivery thence passing either through the economisers or direct to the boilers. The pump room also contains an 8-in. Invincible centrifugal pump direct coupled to a 21-H.P. D.C. motor having a speed of 848 r.p.m., and a 12-in. centrifugal pump by the same makers coupled direct to a 42-H.P. D.C. motor with a speed of 720 r.p.m. The smaller pump is utilised for emptying the hot-well tanks either into the river or reservoir, and the larger one is for filling two large steel tanks situated over the pump room, from which the jet condensing water supply is drawn, although the latter can, if desired, be obtained from the reservoir.

The hot-well tanks receive the discharges both from the

jet and surface condensing plant, and an overflow is provided to the river.

The engines of the exciting units, the Hall feed pumps, and the steam-driven air pump of the auxiliary condensing set, are all arranged to take their steam supply from steam piping arranged on the ring main system.

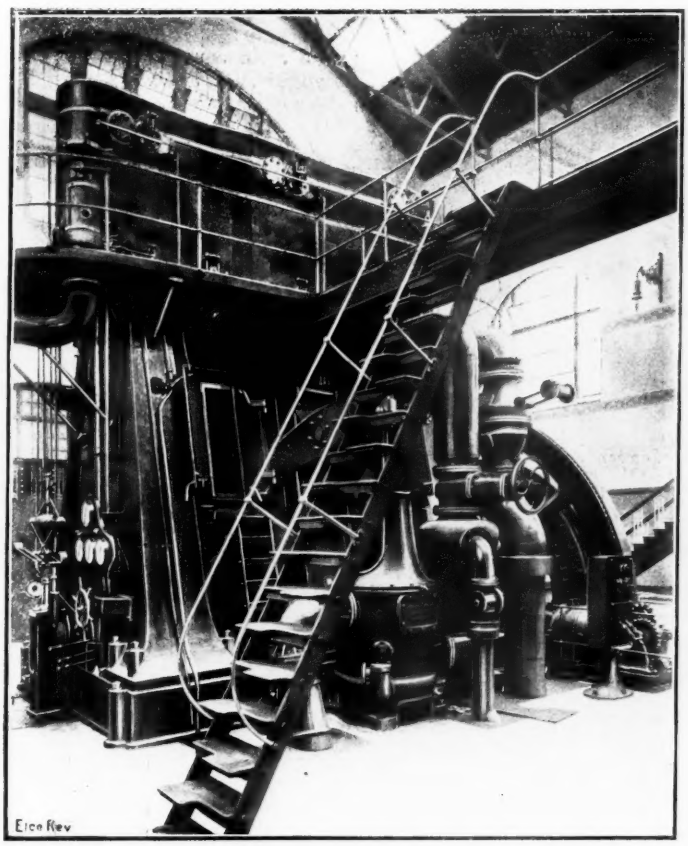


Fig. 4.—View of Main Engine and 'Jet' Condensing Plant.

In the engine room (fig. 5) are situated three triple-expansion enclosed type vertical Corliss engines, having cylinders 18 in., 27½ in. and 43 in. diameter, with a stroke of 3 ft. 6 in. The engines are rated at 815 I.H.P. normal, and 1,015 I.H.P. emergency loads, the normal speed being 80 r.p.m., and the steam pressure at the stop valve 170 lbs. per sq. in. They were built by Messrs. Yates and Thom, of Blackburn, and are direct coupled to Dick, Kerr three-phase alternators. The latter are of the fly-wheel type, although distinct from the engine fly-wheel, and fitted with 60 poles, giving three-phase current at a pressure of 6,000 volts and 40 cycles, the normal output being 500 KW. They are constructed to carry an overload of 25 per cent. and efficiencies, working non-inductively, of 92 per cent. at 25 per cent. overload, 93½ per cent. at full, 92 per cent. at three-quarter, and 89 per cent. at half-load respectively were guaranteed.

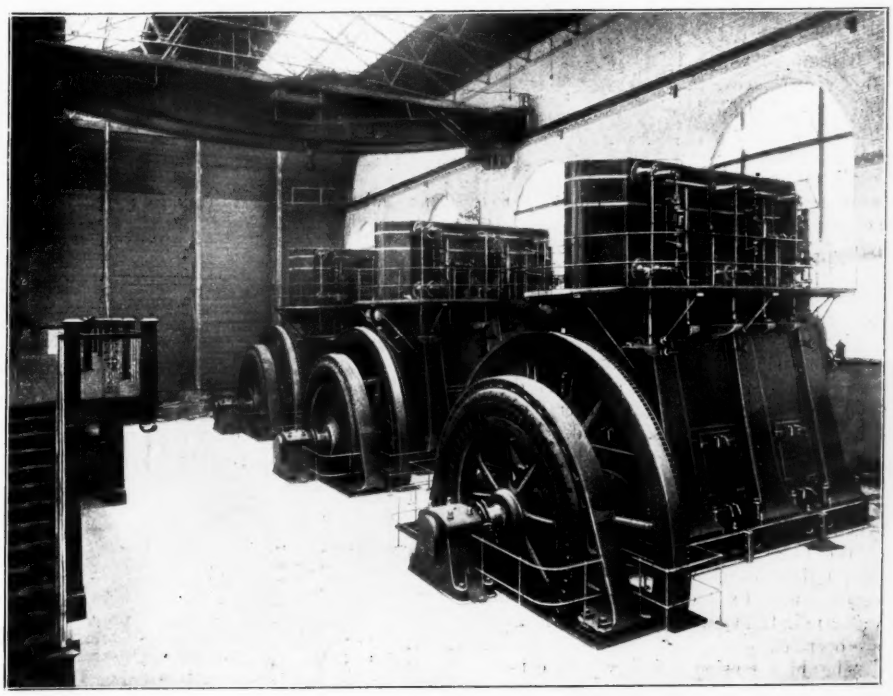


Fig. 5.—View of Engine Room, showing Yates & Thom—Dick, Kerr Generating Sets.

An electrically operated barring gear is provided to the fly-wheels of the main engines, driven by a 10-B.H.P. D.C. motor through suitable worm gearing.

The alternators are excited from separate direct current units, giving a pressure of 230 volts. The latter consist of three sets of

A. H. Gibbings, M.I.E.E.,
Consulting Engineer to the Joint Board.

Belliss high-speed engines direct coupled to multipolar dynamos by Messrs. J. P. Hall and Co., of Oldham.

The engines are rated at 75 H.P., and the dynamos at 50 KW., with an output of 217 amperes. These machines are constructed for overloads of 20 per cent, and their efficiencies were specified to be 90 and 87 per cent. at full and half-loads respectively.

The whole of the steam plant is condensing, the main engines being each provided with a jet condenser and Edwards air-pump, fig. 4, worked from the cross-head, and the exciters, with a small surface condenser, for which the air-pump is of the steam-driven fly-wheel type, and the circula-

ting pump of the centrifugal type, motor-driven. The main engines are provided with alternative exhausts through automatic valves to an 18-in. diameter main exhaust pipe, having an outlet to atmosphere at the end of the station.

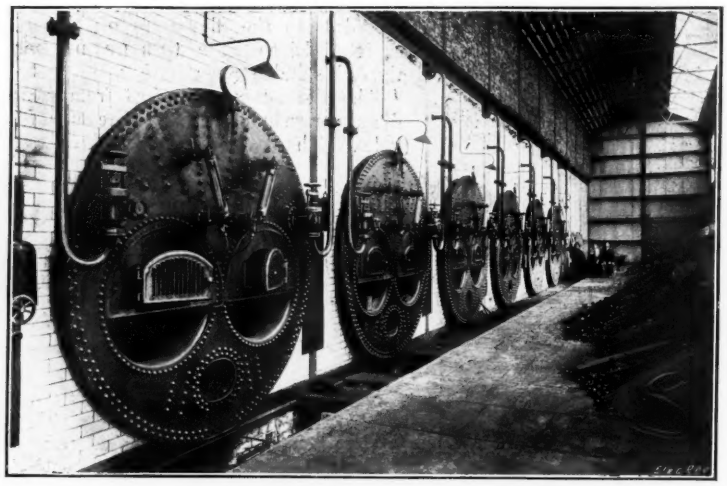


Fig. 6.—View of Firing Floor, Boiler House.

The exhaust steam from the exciter sets can also be turned into the exhaust main, if desired.

The auxiliary surface condensing plant, and the greater portion of the steam and exhaust pipe work, was supplied by the Sir Hiram Maxim Electrical and Engineering Co., Ltd., London.

A 30-ton three-motor travelling crane spans the engine room; this was supplied by Messrs. Higginbottom and Mannock, West Gorton. Sufficient space is available in the present engine room for a further generating set, if required.

On one side of the engine room is arranged the high-tension switchboard for controlling the three main generators and eight outgoing feeders. An additional synchronising panel is placed between the generator and feeder panels, provided with an Everett-Edgcumbe rotary synchroniser. On the gallery in front of the latter panel is situated a signalling pillar, from which a series of signal lamps fixed on the engine room wall and in full view of the engine drivers are operated.

The high-tension switchgear is constructed on the remote control system—*i.e.*, the main switch handles are connected by means of suitable rods and levers to high-tension oil-switches situated in the basement, and all current brought to the panels themselves in connection with the instruments or switches is at low voltage, being taken from the secondaries of transformers situated in the basement. The main switches are provided with tripping coils and fulfil the function of automatic circuit-breakers, the latter action being independent of the handle position.

The generator panels also each contain a main ammeter and mego-watt-hour-meter, field breaking and regulating switches and ammeter.

The switchboard is commendably simple and well adapted for safe handling. Supplementary bus-bars and switchgear are provided for cable-charging purposes, on the Partridge system; excess pressure dischargers of the horn type with suitable earthing devices being employed.

We illustrate the high-tension switchboard in fig. 7, and the high-tension gear situated in the basement is of similar type to that shown in fig. 12, it being understood that the high-tension switches and gear throughout the generating and sub-stations are of similar type.

In the generating station there are also two low-pressure switchboards; one comprising three panels, controls the exciter sets, and the other consisting of six panels is the local power and lighting distributing board, supplied from the exciting units. The latter and the L.T. switchgear are shown in fig. 8.

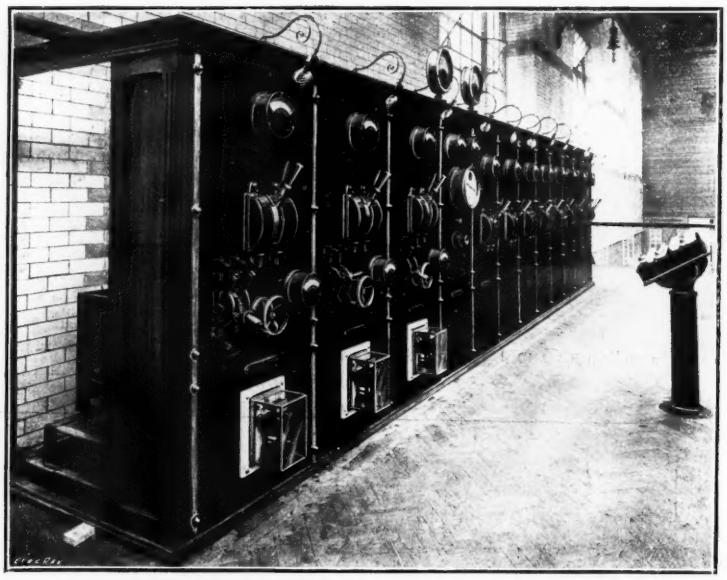


Fig. 7.—High Tension Switchboard, Main Generating Station.

As previously mentioned, there are four sub-stations, connected with the scheme; these are substantially similar in design, and for the purpose of this article, the one situated in Dukinfield is here described. It consists of a machine and switchroom with a basement containing the H.T. switchgear and a battery room arranged in the upper portion of the

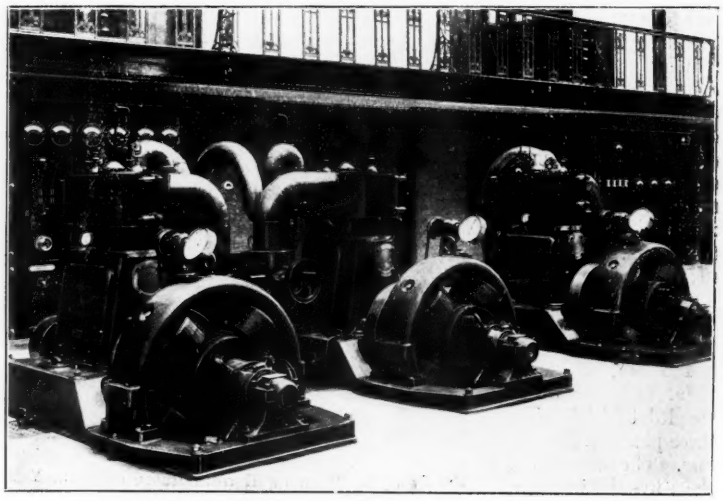


Fig. 8.—Belliss-Hall Exciters and Auxiliary Switchgear.

building, figs. 9 and 13. The plant installed consists of two 200-KW. synchronous motor-generator sets, and space is available for two similar units when extensions become necessary.

There are also installed a balancer set, to deal with an out-of-balance load of 50 amperes, and provided with an induction motor coupled to one extremity, by means of a claw coupling; also a booster set driven by a 45-H.P. direct current motor. The battery is of Tudor make, consisting of 135 cells on each side of the three-wire distributing system, and rated at 750 amperes maximum discharge.

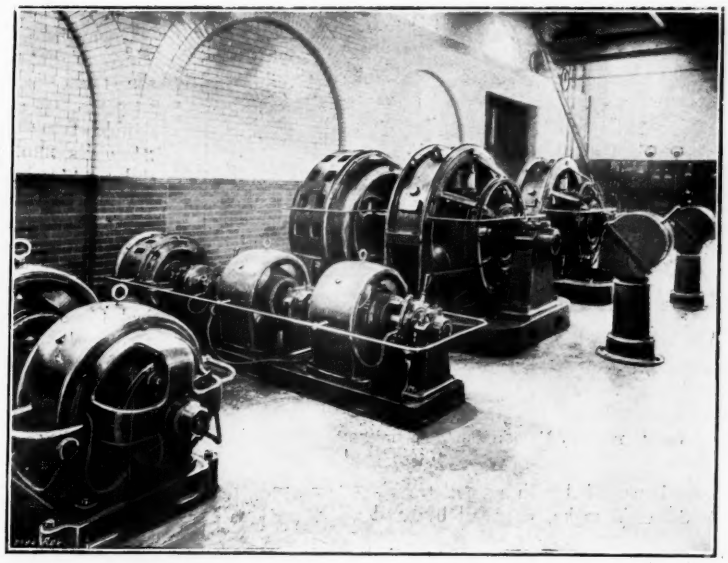


FIG. 9.—DUKINFIELD SUB-STATION: VIEW OF MOTOR-GENERATORS, BALANCER, &C.

The synchronous motor-generators run off the H.T. feeders, and have a normal speed of 400 r.p.m., the generators being arranged to work either as compound-wound machines at 500 to 535 volts for traction purposes, or as shunt-wound machines at 460 volts when feeding the lighting network. The necessary switch for changing over these generators from the lighting to the traction switchboards is arranged on a pillar at the end of each machine.

The fields of the motor-generators are excited from the battery, a change-over switch being provided on the generator panels for cutting out the lighting bus-bars and connecting to the traction bus-bars, or *vice versâ*, at the same time cutting out the field regulators on the lighting board and replacing them by traction field regulators. When the battery is not in use, and the large motor-generator sets standing, the latter are started up through the balancer.

The two balancer units are run in series by means of the induction motor coupled to their extremity, and supply energy at 460 volts to the generators of the large units, which, when running, can be synchronised in the usual manner. The small induction motor is run through an auto-transformer from the H.T. bus-bars, at a pressure of 200 volts.

Turning to the switchgear, the high-tension board is situated at one end of the building; in design it is uniform with that at the power and remaining sub-stations.

It consists of two machine panels, a synchroniser panel and six feeder panels, two of the latter being for the purpose of providing intermediate control on H.T. feeders running to the Hyde sub-station. In the basement, under the above panels, is situated the H.T. gear, the arrangement of which, with auto-transformers and oil switches in compartments, bus-bars suspended from the roof on insulators, and in the foreground the excess pressure dischargers, is clearly shown in fig. 12.

The L.T. traction and lighting switchboards are illustrated in fig. 10; they are of standard design, the former comprises three traction feeder panels, a Board of Trade panel, and two generator panels, while the latter consists of two lighting feeder panels, an earth wire panel, booster motor panel, positive and negative battery panels, and positive and negative booster panels, a balancer panel fitted with the necessary switchgear for controlling the balancer unit and induction motor, when used for starting the motor-generators, and two generator panels.

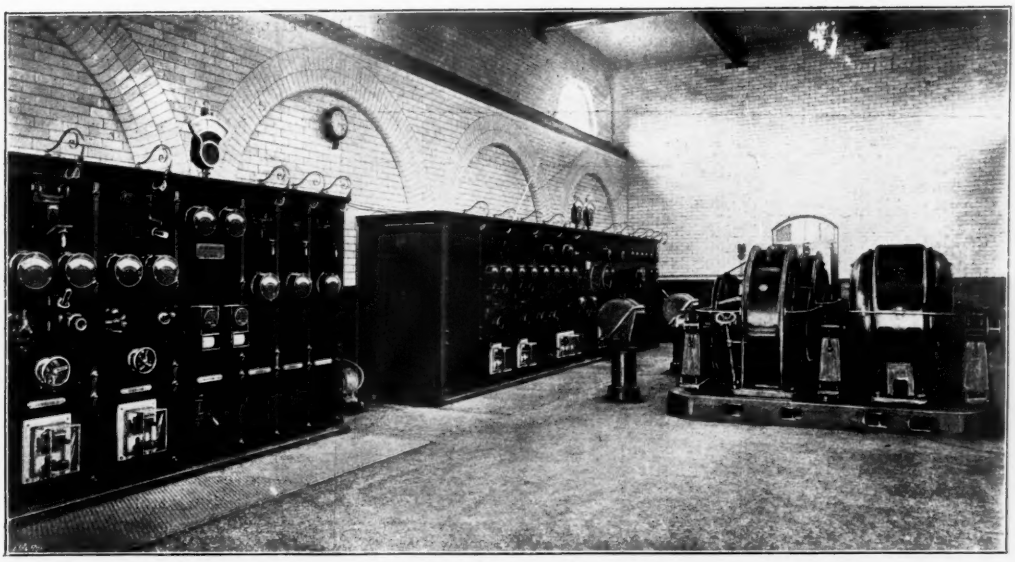


FIG. 10.—DUKINFIELD SUB-STATION: VIEW OF L.T. TRACTION AND LIGHTING SWITCHBOARDS, &C.

The battery regulating switchgear is situated in the battery room above, but controlled by means of the hand wheels on the battery panels, a mechanical connection, suitably enclosed, being provided outside the building.

A small "Reavell" portable motor-driven air compressor is provided in this and other sub-stations for cleaning pur-

poses, while a similar combination of B.T.H. make is in use at the power station.

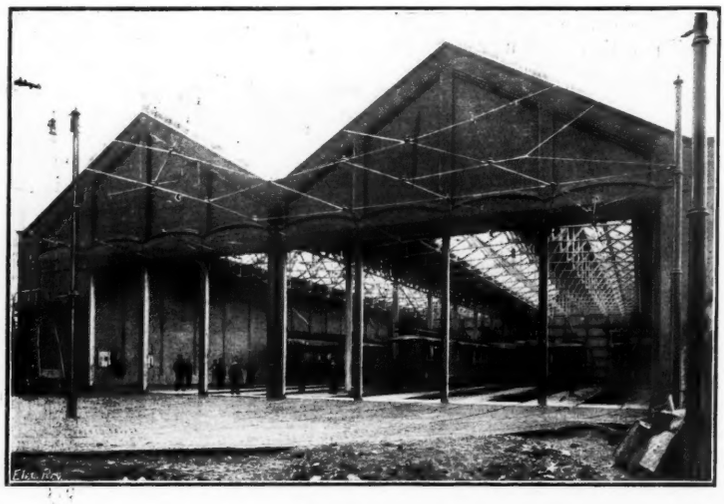


Fig. 11.—View of Main Car-sheds, Stalybridge.

Each of the sub-stations is provided with a small travelling crane, of Morris & Bastert's make, operated by hand from the floor.

It will be gathered from the foregoing that the cable network in connection with the system is of a somewhat extended character.

From the generating station, four H.T. feeders run to the Stalybridge sub-station, two of the latter being extended to the Mossley sub-station; similarly four cables connect up to the sub-station described above at Dukinfield, two of them being extended to the Hyde sub-station. These cables, which were supplied by the British Insulated and Helsby Cables, Ltd., are three-core, paper-insulated and lead-covered cables, with an outer earth sheathing of copper strip. Each of the cores is ·1 sq. in. in section, and the cables are run in 3 in. glazed stoneware conduits of the Sykes patent type, supplied by the Albion Clay Co., laid principally under the road. Draw-in boxes are provided at an average distance of 75 yards apart, and the cables are divided into $\frac{1}{2}$-mile sections at suitable disconnecting boxes.

The L.T. cables were supplied by Messrs. W. T. Glover and Co., Ltd.; the tramway feeders, telephone, pilot and test wires are laid in wooden troughs, filled in solid with bitumen and covered with tiles; the former are paper-insulated lead-covered single-core cables, and the smaller telephone, &c., cables are of the multi-core type, similarly insulated and sheathed. The lighting feeders and distributors are also single-core, and similarly insulated and lead-covered, but being laid direct in the ground are also steel armoured.

Fig. 14 illustrates the arrangement of the L.T. feeders.

Turning to the tramway system, to which slight reference has been made, the track is principally single with turnouts, an exception being $\frac{3}{4}$ mile of double track in Stalybridge. In all 21 miles 390 yds. of single, and 6 miles 667 yds. of double, 4 ft. 8½ in. gauge track, has been laid down. The track is of normal construction, 7 in. girder rails, weighing 99 lbs. per yard, and supplied by Messrs. Bolckow, Vaughan & Co., being laid on a concrete bed 6 in. thick; as gradients of 1 in 10 frequently occur on the routes, the "Cooper" patent anchor joint has been largely made use of in such positions, with a view to preventing "creeping" of the track. On the curves, which are also numerous and of small radius, special 105 lbs. per yd. rails are used. The whole of the points, cast crossings, and special track work have been supplied by Messrs. Hadfield's Steel Foundry Co., Ltd., and are of their "Era" manganese steel; in connection with certain special track work constructed on the site, scarfed joints have been used in place of the ordinary cast crossings.

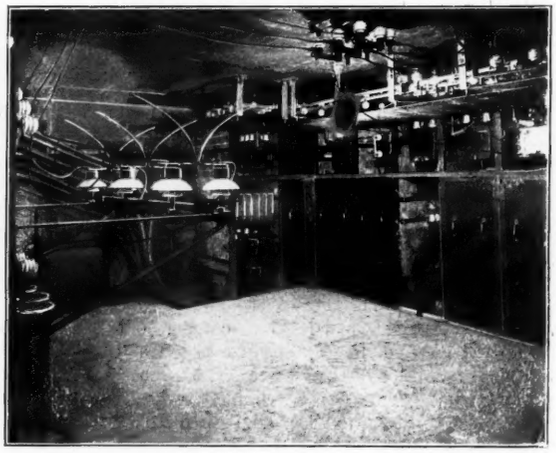


Fig. 12.—Dukinfield Sub-station: H.T. Switchgear in Basement.

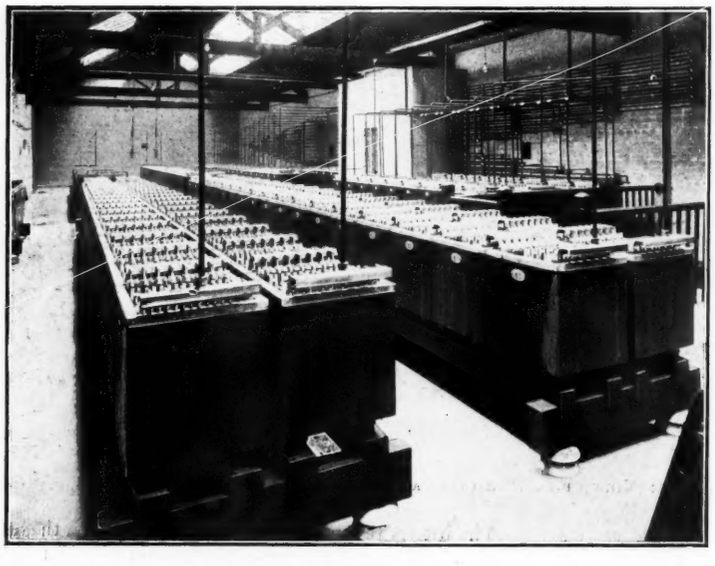


Fig. 13.—Dukinfield Sub-station: View of Battery Room.

The routes are largely paved with granite setts, and the track bonding is of the Neptune type.

The overhead work is practically all side-pole bracket-arm construction. Three sizes of pole have been used, and the trolley wires, which are double throughout, are of 000 B. & S. gauge.

Section pillars of normal type are provided, as usual, at every half-mile of route; these were constructed by Messrs. Veritys, Ltd., and are provided with plug boxes for use with the G.E. Co.'s tramway telephone instruments, one of which is carried on each car.

The feeder connection between the pillar and trolley wire is of 37/18 rubber-insulated lead-covered cable.

In the course of the tramway construction, many difficulties were encountered at bridges, the Clarence Street bridge spanning the canal at Stalybridge was practically rebuilt, and certain of the six railway bridges over the routes necessitated the lowering of the road levels in order to give sufficient head room.

Messrs. Wm. Underwood & Bro., of Stalybridge, were the contractors for the track in Stalybridge and Mossley, and for the three car sheds. The track in the boroughs of Hyde and Dukinfield, was constructed by Messrs. Dick, Kerr and Co., Ltd.

As far as possible, all overhead telegraph and telephone wires have been insulated with a view to avoiding the use of guard wires. Private wires have in some instances, however, been carried across the route on insulators fixed on the tramway poles, by agreement.

For the overhead work, Messrs. Dick, Kerr & Co. were the contractors.

the sub-stations at Hyde and Mossley, and provide accommodation for nine and four cars respectively.

Handsome offices are being built for the joint departments in Waterloo Road, Stalybridge, and office accommodation of a suitable kind is provided at both the generating and sub-stations.

The whole of the architectural work in connection with the buildings was carried out by Messrs. Matear and Simon, of Liverpool, who also supervised their erection.

Before closing this description, we may remark that the Board, at Mr. Gibbings's suggestion, has adopted exceedingly moderate tariffs to both lighting and power consumers, and has also decided to carry out a motor-hiring scheme.

The commercial management of the undertaking is in the hands of Mr. F. Schofield, and the resident engineer is Mr. R. Blackmore.

In conclusion, we beg to thank Mr. Gibbings for kindly giving us permission and facilities to prepare this article.

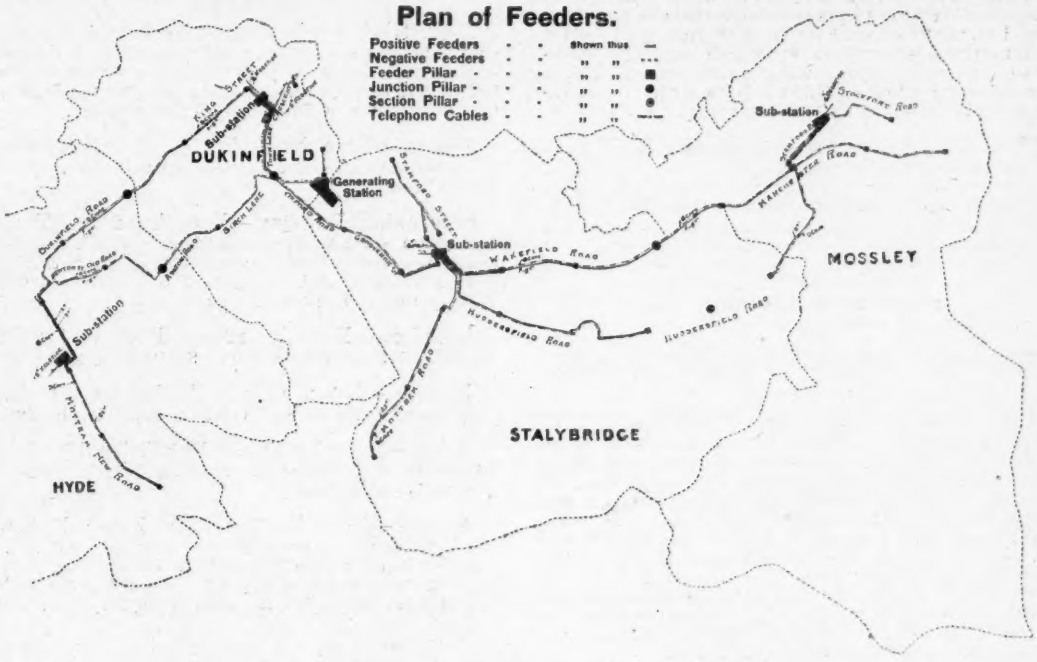


Fig. 14.—Plan of l.t. Feeders, Joint Electrical Scheme.

Several different types of car are in use—viz., double and single-deck cars and combination cars, numbering in all 40.

The double-deck cars have seating accommodation for 57 passengers, the single-deck variety carry 26 passengers inside and 4 on the platform, while the combination cars seat 16 passengers in the central covered portion and 20 more on the two open end platforms.

The wheel-base of all the cars is uniformly short, viz., 5 ft. 6 in. The car bodies were built by the British Electric Car Co., Ltd.; the trucks are of McGuire 21 E M type, and "Griffin" chilled-iron wheels are used. The contractors for the rolling stock were the British Westinghouse Co., and the electrical equipment comprises two 30-h.p. Westinghouse motors and Newell magnetic brakes, in addition to rheostatic and hand brakes.

Life-guards of the Hudson & Bowring and Wilson Bennett types are fitted to all the cars, as also is Edmundson's earthing device.

The car-sheds are three in number; the principal one, to accommodate 50 cars, and situated in proximity to the generating station, is shown in fig. 11; it is some 150 ft. long × 99 ft. wide. Eight tracks are here provided, with the necessary inspection pits, and a traverser of Heenan and Froude's make connects the various tracks, at the rear of the shed.

Suitable repair shops, stores, and a men's mess room are also provided.

The remaining car-sheds are built in connection with

TRAMWAY AND RAILWAY NOTES.

(*Continued from page 785.*)

Pontypridd.—The L.G.B. has sanctioned a loan of £6,000 for the purchase by the U.D.C. from the B.E.T. Co. of the old horse tramway between the town and Hafod.

Royton and Crompton.—The new tramways through Royton and Crompton, coupling up Oldham and Rochdale, were on Tuesday officially inspected by Col. Druitt, R.E., and Major Trotter, R.E., of the Board of Trade, and declared satisfactory, the lines being immediately afterwards opened for public traffic. The contract has been carried out by Messrs. Wm. Underwood and Bros. of Dukinfield, and comprises 6½ miles of single track, with 23 junctions, loops and cross-overs, and 30,000 yards of new granite paving. The work has been constructed in the short period of 14 weeks from the time of commencement to the day of the running of the first car. In addition to the tramway contract, the contractors have also carried out large street improvements along the route in the Crompton district, the whole of the roads being reconstructed. Some 16,000 yards of new granite, and redressed granite setts, have been laid on new foundations, the kerbs and footpaths and drains, &c., also being relaid. During the whole of the work the traffic has been maintained through a very congested district from Oldham to Rochdale. The consulting engineer for the whole scheme has been Mr. Reginald Wilson, of Westminster, with Mr. A. G. Marshall as resident engineer. Mr. J. R. Crisp was the engineer for Messrs. Underwood & Bros., and had sole charge of the work. By the completion of this route, it is now possible to travel by electric tram right from Bury to Manchester, Rochdale, Oldham, Ashton and Stalybridge.

South Australia.—The Electric Tramway Bill under which the Government proposes to take over the various horse tramways and establish electric in place of animal traction has

received the approval of the Adelaide City Council. Some of the suburban municipalities are, however, opposed to the scheme.

Tube and Other Railway Schemes.—The following notice has been issued by the Board of Trade:—

In view of the preliminary steps in compliance with Standing Orders of Parliament required to be taken at this period of the year by persons interested in the promotion of Private Bill legislation for the ensuing Session, inquiries have been made of the Board of Trade with the object of learning whether proposals for the authorisation of new "tube" or other railway schemes, in or near London, should await the report of the Royal Commission on London Traffic in accordance with the intimation made in the House of Lords on August 6th, 1903.

On that occasion the Lord Chairman of Committees said:—

"It is impossible for Parliament to consider any new schemes for new tubes or large railway extensions through London until the Commissioners have reported. I do not, of course, refer to measures dealing with existing lines, alterations of capital, purchases of small portions of land, or matters of that kind."

It is, of course, open to promoters to make application to Parliament for Bills in the usual way, and it is possible that Bills may be presented containing proposals of pressing public importance which Parliament might think it right to proceed with at once. But as regards all ordinary proposals for new tubes and large railway extensions, the President of the Board of Trade is of opinion that, until the Commissioners have issued their report, and Parliament has had an opportunity of considering its recommendations, Lord Morley's warning to promoters still holds good. He understands that the Parliamentary authorities concur in this view.

Sheffield.—The following notice of motion for Wednesday's Council meeting had been given:—

"To move that it be an instruction to the Tramways Committee to forthwith withdraw the notice placed in the tramcars and on the back of the tickets seeking to limit the liability of the Corporation to a sum of £25 in case of accident to anyone using the cars."

TELEGRAPH AND TELEPHONE NOTES.

German Atlantic Telegraphy.—The German Atlantic Telegraph Co., which is now taking over the Borkum—Vigo cable undertaking of the German Marine Telegraph Co., is making a fresh issue of shares to the extent of £200,000 for this purpose. It appears that the subsidy receivable from the German Government for the use of the two Atlantic cables will amount to £81,000 in 1905, £82,500 in 1906, and £84,000 in 1907. The directors state that the receipts for the first 10 months of the present year show an increase of £14,500 over the corresponding period of 1903, and this must be attributed to the bringing of the second cable into operation. The company, which has a combined share and bond capital of £2,200,000, paid a dividend of 5½ per cent. for 1903, as against 5 per cent. in 1902 and 4½ per cent. in 1901.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1)	Aug. 26, 1901	
Trinidad-Demerara (No. 2)	Oct. 10, 1904	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Reissa-Issa (Yemen)-Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	
Closed { Port Arthur-Chefu	Mar. 9, 1304	
Paramaribo-Cayenne	July 13, 1904	
Cape Haitien-Mole St. Nicholas	Aug. 20, 1904	Nov. 8.
Swakopmund-Mossamedes (under repair)	Oct. 10, 1904	
Bolama-Bissao	Oct. 13, 1904	
Nassau-Jupiter Inlet	Oct. 20, 1904	
Rhodes-Sitia	Nov. 1, 1904	
Salonica-Lemnos	Nov. 6, 1904	
Landlines.		
Cartagena-Baranquilla	Dec. 8, 1900	
Puerto-Barrios	July 28, 1902	
Caimanera-Santiago	June 15, 1904	
via Bhamo beyond Tingyuch	Oct. 15, 1904	
Kertch-Soutchoum	Sept. 27, 1904	
via Fao route	Nov. 2, 1904	Nov. 7.

Islington.—At the meeting of the B.C. on Friday, the Works Committee reported having had under consideration a letter from the London County Council calling attention to the difficulties between the General Post Office authorities and the B.C., in the matter of way-leaves and consents for underground telegraph works in Islington. The Committee had for some time past been in correspondence with the General Post Office on the question of these consents, considerable difficulty having arisen owing to the unwillingness of the Post Office authorities to comply with the conditions which the Borough Council had from time to time found it necessary to impose, in order that the execution of such works might not unduly interfere with the Council's own works carried out under statutory authority. The Department maintained that it had certain rights in connection with the laying of these underground telegraphs, but while objecting to the conditions laid down by the Committee on the advice of the borough engineer, had notified its willingness to accept a general condition that the work should be carried out to the satisfaction of the borough engineer. The Committee was of opinion that the general condition proposed by the Post Office authorities should not be substituted for the conditions imposed from time to time as each application arose, and that the Council should point out to the secretary to the General Post Office that the conditions imposed in dealing with their applications for consents to the works of the nature indicated were laid down in the interests of the borough and of the community, and would not consequently be rescinded, but that due consideration had been, and would be, given to the wishes of the Department in determining the nature of the Council's requirements. The report was adopted.

Portsmouth Telephones.—The Council is going to apply to the L.G.B. for sanction to borrow £20,000 to cover future extensions to the telephone system, this estimate including 1,000 lines at £20 each.

CONTRACTS OPEN AND CLOSED.

OPEN.

Belfast.—November 18th. Permanent way, overhead electrical equipment, feeders, telephone and other wires, conduits, steam dynamos, switchboard, three-phase plant, condensing plant, boilers, coal conveying plant, piping, pumps, tramcars, &c., for the Corporation. See "Official Notices" November 4th.

Bolton.—November 30th. The Electricity Committee has a vertical engine and two alternators for sale. See "Official Notices" to-day.

Caledonian Railway.—November 21st. Tenders are invited for a year's stores, including telegraph and telephone appliances, electric lighting material and fittings, &c. Specifications, &c., from Mr. J. Lorimer, Stores Superintendent, Caledonian Railway, Charles Street, St. Rollox, Glasgow.

Deptford.—November 22nd. Pipework for the Town Hall electric lighting installation. See "Official Notices" to-day.

Dundee.—November 12th. Replacing copper strip mains with insulated cables. See "Official Notices" October 28 h.

Erith.—November 11th. Electric lighting of the offices of the Erith Education Committee at Picardy. See "Official Notices" October 21st.

France.—November 18th. The French Post and Telegraph Authorities are inviting tenders until the 18th inst., for the supply of a quantity of electric cables. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, Rue de Grenelle, 103, Paris.

Hammersmith.—November 15th. Electric wiring for the new workhouse and infirmary at Wormwood Scrubs; also two motor transformers and a battery for the Guardians. See "Official Notices" October 28th.

Hammersmith.—November 16th. Extra high tension feeder mains; draw boxes, frames, covers, &c., for the electricity department. See "Official Notices" November 4th.

Johannesburg.—December 27th. Transformer pillars and switchgear; also two 35-ton electric overhead travelling cranes, for the Municipal Council's electrical undertaking. See two "Official Notices" October 28th.

Manchester.—November 11th. Wiring for arc and incandescent lighting for Stuart Street generating station. Apply Secretary, Electricity Department, Town Hall. Deposit £2 2s.

Manchester.—November 22nd. Three electric travelling cranes for the Tramways Committee. See "Official Notices" to-day.

Newport (Mon.).—November 21st. Machine tools for the Electricity Department. See "Official Notices" to-day.

Oldham.—November 25th. Two negative return feeder boosters with switchgear and boards, for tramway system. See "Official Notices" to-day.

Roumania.—January 28th, 1905. Tenders are being invited by the municipal authorities of Guirgin for the concession for the electric lighting of the town.

Shanghai.—March 31st, 1905. Construction and working of 24 miles of electric tramways on the trolley system, double or single. See "Official Notices" October 14th.

Swansea.—November 12th. Removal, alteration and re-erection of a 450-I.H.P. triple-expansion engine and a 225-KW. continuous current dynamo. Also an 8-ton travelling hand-crane, for the Electricity Department. See "Official Notices" October 14th.

Whitby. — November 21st. 200-kw. direct-current dynamo and high speed engine, also one water-tube boiler with chain grate stoker, for the U.D.C. See "Official Notices" October 21st.

Wolstanton and Burslem. — November 15th. The Guardians are prepared to receive tenders for the supply and erection of electric lighting plant, water-tube boilers, feed pumps, two 25-kw. steam dynamos and a booster, switchboard, cables and wiring, accumulators, and arc lamps. Specifications may be obtained at the office of the electrical engineer, Mr. Ashton Bremner, Market Buildings, Burslem (deposit £2 2s.).

CLOSED.

Abergavenny.—An order has been placed with Messrs. Pritchetts & Gold, Ltd., of Feltham, Middlesex, for a battery of 130 cells for Abergavenny Asylum.

Camberwell.—The Board of Guardians has accepted the tenders of the following firms for electrical fittings, &c., for the new Infirmary, and during the year:—Bell's Asbestos Co.; General Electric Co.; Reed's Electrical and Engineering Supply Co.; and W. H. Willcox & Co.

Cleckheaton.—The U.D.C. has accepted the tender of Messrs. Dorman & Smith for the supply of accessories required for the extension of the switchboard at the electric light works, at £120.

Devonport. — The Sub-committee of the Corporation Electric Power Committee has accepted the tender of the Electric Construction Co., of Wolverhampton, for the supply of a Willans engine and a generator, at £3,443.

Gillingham (Kent).—The T.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for the supply of cables and plant, at £274, and that of Messrs. Witting, Eborall and Co., Ltd., for motors on the hire-purchase system.

Hastings.—The T.C. has accepted the tender of the Langdon-Davies Motor Co., Ltd., for the supply for seven years of motors for hiring out and selling on the hire-purchase system.

London.—The Fire Brigade Committee of the London County Council have received the following tenders for the wiring and fittings at the Burdett Road sub-station:—

National Electric Construction Co. (accepted)	£124 15
W. H. Johnson	125 5
Donnison, Sillem & Co.	130 0
Durell & Co.	131 18
F. J. Coleby & Co.	137 10
A. H. Marshall & Co.	138 10
G. Weston & Sons	139 10
Oliver Clark & Co.	145 0
Leo Sunderland & Co.	147 0

Newport (Mon.).—The tender of Messrs. A. G. Arnold and Son has been accepted for electric lighting and equipment of the Manual Training Centre for the Local Educational Committee.

Salford.—The T.C. has accepted the following tenders:—

Salford Oil Refining Co., 25 barrels of crank chamber oil for the electric light works, 1s. 2d. per gallon.

Mr. A. Bridge, erection of transformer sub-station at Prestwich, £220.

W. T. Glover & Co., Ltd., cables for Prestwich, £1,530.

Siemens Bros. & Co., Ltd., rubber-insulated cables (3,000 volts), fine solder, &c.; also the United Asbestos Co., Ltd.; Keighley Electric Engineering Co., Ltd.; Mr. H. Luke; Messrs. Baxendale and Co.; Reason Manufacturing Co., Ltd., electrolytic meters and house fuse boxes (concentric); Key Engineering Co., Ltd., small motor starters; Messrs. Lancaster & Tonge, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Messrs. John Greenwood & Son; Messrs. Doulton & Co., Ltd.; Messrs. Royce, Ltd., large motor starters; Receivers and Managers of Ferranti, Ltd., motor-meters; British Westinghouse Electric and Manufacturing Co., Ltd., alternating current meters; Messrs. W. W. Hill & Son, leads.

Stepney.—The B.C. has accepted the tender, at £34, of Messrs. Ward Bros., for installing the electric light in the Board Room of the Public Health Offices.

Wandsworth.—The B.C. received tenders for the installation of electric lighting at the Council House, ranging from £281 14s. to over £550. The lowest—that of Messrs. W. H. McKone & Co.—was accepted.

Patent Office—Assistant Examiners. — An open competitive examination for not fewer than 20 situations as assistant examiner in the Patent Office will be held by the Civil Service Commissioners in January next. The examination will commence on the 2nd of the month, and forms of application for admission to it are now ready for issue, and may be obtained on request addressed by letter to the Secretary, Civil Service Commission, Burlington Gardens, London, W.

FORTHCOMING EVENTS.

Friday, November 11th.—Tramways and Light Railways Association. Visit to the L.C.C. power stations and car-sheds.

Electro-Harmonic Society. Ladies' night.

Saturday, November 12th.—At 2.15 p.m. at works. Institution of Electrical Engineers (Manchester Students). Visit to Messrs. Mather & Platt, Ltd., Salford Iron Works.

Monday, November 14th.—Institution of Mechanical Engineers (Graduates'). Mr. T. P. B. Cliff on "New Electrical Swing-Bridge over Flood-course of the River Weaver, Northwich."

Tuesday, November 15th. — At 8 p.m. Institution of Civil Engineers. "Distribution of Electrical Energy," by J. F. C. Snell.

Wednesday, November 16th.—At 8 p.m. Society of Arts. Inaugural address by Sir William Abney, K.C.B., D.Sc., &c.

At 7.30 p.m. Institution of Electrical Engineers (Students'). Opening address by Mr. J. Swinburne.

At 5.30 p.m. Chemical Society. Meeting.

Thursday, November 17th.—At 2.30 p.m. Institution of Electrical Engineers (Students'). Visit to the G.E.R. Locomotive, Carriage and Wagon Shops, Stratford, E.

At 7.15 p.m. Institution of Electrical Engineers (Leeds). At University. President's inaugural address and paper on "Large Gas Engines for Central Stations," by Mr. H. Campbell.

Friday, November 18th.—At 8 p.m. Junior Institution of Engineers. Presidential address by Mr. H. Lindley, of Frankfort-on-M., on "Municipal Engineering on the Continent."

North-East Coast Institution of Engineers and Shipbuilders. Meeting at Newcastle.

Saturday, November 19th.—North-East Coast Institution of Engineers and Shipbuilders (Graduates'). At Newcastle. Mr. R. A. Pringle on "The Application of Electricity to the Driving of Machinery."

NOTES.

London Electrical Contractors' Association.—The annual general meeting of this Association was held at Frascati's Restaurant, on Monday last week. There were present Mr. E. L. Berry, the president (in the chair), supported by Messrs. Wm. Rawlings, Holborn, Strode, Marryat, Woodward, Joseph, and a number of other gentlemen, including the hon. solicitor, Mr. R. Tweedie Smith, and C. W. Charles, as secretary *pro. tem.* The treasurer, Mr. Wm. R. Rawlings, presented the balance-sheet, which was adopted; and at Mr. Woodward's request a copy is to be posted to all members. The President then addressed the meeting at some length regarding the articles of association, monthly meeting, Standing Committee, Social Committee, and also on the work of the Law and Parliamentary Committee. He also dwelt on the forthcoming London County Council Omnibus Bill, and urged all members present to use their influence to the utmost; and bring considerable pressure to bear upon the Parliamentary representatives to oppose the Bill. He spoke of the model specification, and on the advantages of the workmen's certificates. He pointed out that a large number of members having paid their subscription, took no further interest in the work of the Association. He pressed all members to be up and doing, and to be keen in looking after their own interests, more particularly so far as that interest was concerned by the manufacturers' agreement. The President concluded his address by referring to the very excellent work, so ably done by the retiring secretary, Mr. E. J. Hogan, and suggested that the present of £25 to be given to Mr. Hogan, should be increased to £50. This was formally proposed by Mr. Soutar, seconded by Mr. Brightwell, and carried unanimously. Mr. Hogan then returned thanks. There followed considerable discussion as to the black-balling methods of the manufacturers, one member having resigned on this account. The following officers were then elected:—

Chairman.—E. L. Berry. Vice-Chairman.—W. Strode.
Treasurer.—Wm. R. Rawlings. Secretary.—C. W. Charles.

Committee.

Messrs. Phipps, Marryat, Lund, Ratcliffe, Trickett, Joseph, Messop, Troup, Woodward, Tate, Duncan Watson, Blackwood, Wardrop, Owen Smith, Seymour, and Soutar.

Hon. Solicitors.—Messrs. Turner & Co.
Auditors.—Messrs. Bowden, Smiles & Co.
Delegates to Central Board.—Messrs. Berry, Lund, Phipps and Strode.

Mr. R. Tweedie Smith addressed the meeting later on the question of overdue accounts and conspiracy of manufacturers. He also referred to the action against Messrs. Stubbs. He spoke of the apathy of the contractors, and urged all present to use every effort to prevent a system of Tammany in London. He would even go so far as to disfranchise the employés of the electrical departments of municipal bodies.

Mr. Berry then proposed, "That the central board be requested to immediately inaugurate strong opposition to the London County Council Bills which are detrimental to the rights of contractors, and that every member throughout the United Kingdom be requested to ensure the opposition of their Parliamentary representative;" this was seconded by Mr. Noble, and carried unanimously.

Mr. Seymour proposed, and Mr. Murrell seconded, a most hearty vote of thanks to the retiring council. The meeting was terminated by a enthusiastic vote of thanks to the chair.

Iron and Steel Institute.—A Reuter dispatch, dated New York, October 26th, says that the first business session of the autumn meeting of the Iron and Steel Institute was held on that day. Mr. Carnegie, the President, announced that his successor as President was Mr. R. A. Hadfield, of Sheffield (England), from whom a letter was read thanking the Institute for the honour conferred upon him.

Physical Society.—At the meeting held on October 28th, 1904, Dr. R. T. Glazebrook, F.R.S., President, in the chair, a paper on "An Interference Apparatus for the Calibration of Extensometers," by Mr. John Morrow and Mr. E. L. Watkin, was read by Mr. Morrow. The paper describes an apparatus for calibrating extensometers and similar instruments by comparison with the wave-length of sodium light. The apparatus is self-contained and easily made ready for use. It is capable of great accuracy, as it is unaffected by external disturbances, accidental displacements, or errors due to backlash in the apparatus itself.

A paper on "A Sensitive Hygrometer," by Dr. W. M. Thornton, was read by the Secretary. The instrument is made by enclosing the cooled surface of a Regnault's hygrometer in a glass globe, so that only the mass of vapour contained in the vessel is available for condensation. The cooled surface is made much smaller than usual —about 1 sq. cm. The surface-density of the deposited moisture depends on the total quantity of water-vapour present.

A "Note on a Property of Lenses," by Dr. G. E. Allan, was read by the Secretary.

The British Fire Prevention Committee.—The British Fire Prevention Committee's work for the impending winter session, which has just commenced, includes the preparation and issue of an important report on the great Baltimore conflagration. Further reports will be issued on various tests with sprinklers, lamps, and different forms of partitions. A report is also to be issued by the Committee regarding its special commission's journey in Central Europe. The competition in respect of the children's fable closes on October 31st, and will be dealt with during the winter. An arrangement has been arrived at with the National Fire Protection Association of the United States by which members of the Committee are eligible as members in the American Association, and *vice versâ*. Some 20 American professional men have already joined the Committee. Arrangements are also being made for the organisation of branches of the Committee in Canada, Australia and New Zealand. The Committee will assist in the preparation of the International Technical Dictionary, which is being issued by the German Institution of Engineers, as far as technical terms regarding fire prevention are concerned. It has been decided that the library which is being formed by the Committee shall be henceforth known as the International Fire Library, and it will be managed on somewhat independent lines, by the following Library Sub-Committee, namely, Messrs. James Sheppard, A.I.E.E. (chairman), Percy Collins, Charles E. Goad, M.Am.I.C.E., Ellis Marsland, Edwin O. Sachs, F.R.S. Ed., and E. de Segundo, M.I.M.E. The Library already counts 1,250 numbers; many of the numbers comprise sets of publications or annual reports, so that the number of individual volumes in the Library already exceeds 3,000.

Laterite as an Aluminium Ore.—A paper was read before the Faraday Society on October 25th, by Miss Buena Pool, B.Sc., on "A Suggested New Source of Aluminium." The ore in question is the bauxite-like material known as laterite, which is found in India. It is a mineral of various colour, depending upon the iron in it; and its consistency *in situ* is that of putty, although it becomes harder by loss of water on exposure to air. Originally laterite was considered a clay, or aluminium silicate, but "recently" it has been shown to be an hydrated alumina mixed with silica. Miss Pool quotes at length the analyses of Indian laterite, made and published last year by Drs. H. and F. J. Warth, and by Mr. T. H. Holland in the *Geological Magazine*, which show that the mineral exists in four modifications. The first is pure gibbsite, $Al_2O_3.3H_2O$, or $AlO(OH)H_2O$, found only at Kodikanal, in the Madura district of the Madras presidency, and containing nearly 95 per cent. of aluminium oxide after ignition. The second are pisolitic laterites, or bauxites, $Al_2O_3.2H_2O$, having the high degree of purity characteristic of wocheinite. These contain from 57 to 68 per cent. of alumina, from 4 to 6·5 per cent. of ferric oxide, from 0·9 to 2·4 per cent. of silica, and from 1 to 6·6 per cent. of titanic acid. The third group consists of what are usually termed high-level laterites, and are more like ordinary bauxite. They contain from 13 to 56 per cent. of ferric oxide, and from 0·4 to 4·2 per cent. of silica. The fourth group are the low-level laterites, containing more iron and much clay, which are fusible before the blowpipe. Mr. Holland has pointed out that laterite only exists in tropical climates, and where much running water is present, and he suggests that the material has been formed through some bacterial agency from the silicates of igneous rocks. Where there is not much rainfall a substance known as "kunkar" is found, which is similar to laterite, except that it contains much lime.

The object of Miss Pool's paper was to call attention to the vast deposits of laterite in India, which, existing as they do in the neighbourhood of running water, would appear to lend themselves readily to electrolytic reduction with the aid of water power. It might have been added that the identity of laterite and bauxite was pointed out by Bauer in 1898 (*Neues Jahrbuch für Mineralogie, &c.*, 1898, II., 163), as a result of his investigations in the Seychelles. Also that laterite, according to Holland, is an intermediate stage in the conversion of gibbsite into the more stable diaspore, $Al_2O_3.H_2O$ or $AlO(OH)$.

Carborundum and Gas Retorts.—A good example of the excellent properties of carborundum as a material for effecting repairs in furnaces and the like has been reported from Germany. In one of the largest gasworks there two retorts had become very leaky. A mixture of equal parts, by weight, of carborundum and fire-clay was made into a paste with water, and the cracks were stopped—an operation which took only three minutes, as it was performed upon the retorts while still red hot. At the end of that time the retorts were charged with coal in the usual way, and were found, by a special test, to be perfectly sound. These retorts remained in use for about three months without becoming leaky again, and they would probably have lasted longer, but for the fact that the entire furnace containing them was then taken down, for other reasons. When carborundum is to be employed for the repair of red-hot articles, as above described, it must be mixed with fire-clay of good refractory properties; but when it is to be applied to a cold object, it may be employed as a mixture with one-third its weight of water-glass. The retorts of gasworks may with great advantage be given a coat of carborundum and either fire-clay or water-glass inside and out, until the layer is about 0·5 millimetre thick; and coke ovens may be treated in a similar fashion, or have their cracks stopped with a paste.

Society of Engineers.—At a meeting held at the Royal United Service Institution on Monday evening last, a paper was read on "Recent Developments in Crushing and Concentrating Machines," by Mr. James Thame.

Pictorial Fame.—We are obliged to "A. M. T." for a picture post-card, showing the chaotic condition of the ruined gasworks at Saltley, after the insidious fluid had accomplished its fell work. We pity our friends, the gas people, who have to deal with such a frightfully dangerous and destructive agent, and whose misfortunes have been crowned by this last unkind cut!

Royal Society.—The following is a list of Fellows who have been recommended by the President and Council of the Royal Society for election to the Council for the year 1905, at the anniversary meeting to be held on November 30th:—President, Sir William Huggins, K.C.B., O.M.; treasurer, Mr. Alfred Bray Kempe; secretaries, Prof. Joseph Larmor, Sir Archibald Geikie; foreign secretary, Mr. Francis Darwin; other members of the Council, Dr. Shelford Bidwell, Mr. George Albert Boulenger, Colonel David Bruce, R.A.M.C., Mr. Frank Watson Dyson, Prof. Percy Faraday Frankland, Prof. Francis Gotch, Dr. Ernest William Hobson, Prof. John Newport Langley, Mr. John Edward Marr, Sir William Davidson Niven, K.C.B., Prof. William Henry Perkin, jun., Prof. John Perry, Mr. Adam Sedgwick, Dr. William Napier Shaw, Prof. William Augustus Tilden, Rear-Admiral Sir William Wharton, K.C.B.

Long-Distance Transmission.—The Stanley Electric Manufacturing Co., of Pittsfield, Mass., U.S.A., has sent us a large wall map of the area affected by its long-distance electric transmission schemes in California. The longest transmission distance up to the present, is 232 miles—from De Sabla power house to Sausalito, *vid* Cordelia. Also, it is stated, 10,000 H.P. is being regularly delivered into San Francisco from Electra, *vid* Stockton and Mission San Jose, a distance of 147 miles. The lines finished and proposed are shown on the map, and photographic views of the flume, power houses, transmission lines, sub-stations, and so on, are introduced at suitable points. This map is very acceptable to us as showing the important work which is taking place in other parts of the world in long-distance electric transmission. It may not possess much, if any, direct interest in connection with electrical transmission work in the United Kingdom, but there will be long-distance transmission work of considerable importance in South Africa, India and Australasia before long, and the valuable opportunities which California has offered to the American electrical engineer to develop in this direction will afford a basis upon which to work.

South African Notes (from our Durban correspondent).

Durban, Natal.—At a Town Council meeting on October 7th, it was decided, on the recommendation of the Telephone Committee, to indent for 1,000 subscribers' telephone sets at an approximate price of £2 10s. each. The telephone manager reported that 21 new connections had been made during the month, making a total of 939; 131 offices had been wired in tubing preparatory for the new system, in connection with which 3,360 yards of cables had been drawn in, and most of the conduits and pipes were laid.

The doubling of the track in Berea Road was approved of at an estimated cost of £5,107.

The tenders invited locally for cables resulted in the Henley Cables Co.'s tender of £182, for 1 mile H.T. cable, and the B.I. and Helsby Cables Co.'s tender of £1,499, for 5 miles of assorted L.T. cables being accepted. It was also decided to largely increase the incandescent lighting of the suburban streets.

Johannesburg (Transvaal).—The Town Council has accepted the tender of Messrs. Strong & Moore, of Durban, for work in connection with the tramway permanent way, Section No. 1, for laying 5½ miles of double track and necessary road making and surface drainage in connection therewith, for the sum of £41,610 19s. 6d., being nearly £10,000 below the next lowest tender. The work will be put in hand at once.

Another correspondent sends the following:—

King William's Town.—The electric lighting installation at the new market buildings was carried out by Messrs. Ryan & Peterson, to the plans of the borough engineer, Mr. J. Maden.

Cape Town.—The Municipal Committee in charge of the electric lighting is going in for retrenchment, in consequence of the refusal of the ratepayers to grant the loan of £100,000. All street lighting improvements are cancelled, and no further steps are to be taken in development, except the completion of contracts in hand. The arc lamp standards, for which tenders have been received, are to be dispensed with, and the provision of Nernst and arc lamps has also been cancelled.

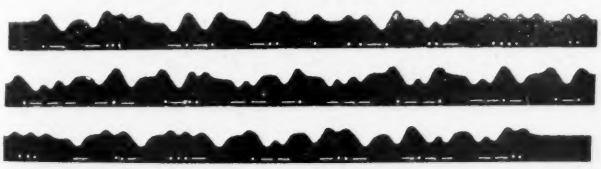
East London.—At a meeting of the T.C., a letter was read from the Sun Insurance Co. in reference to the recent outbreak of fire at Messrs. Rubinstein & Co.'s premises, in the course of which attention was directed to Mr. Assessor Mouatt's report, which incidentally

stated that the fire originated with the switches of the upstairs "lights," and condemned generally the "very defective manner in which electrical installations are carried out in East London, and the absence of intelligent supervision or control." Reporting on the matter, the town electrical engineer said there was not the faintest evidence to show that the cause of the fire was electrical, and he questioned whether the assessor was qualified to speak on electrical matters at all.

Nernst Lamps in America.—It was recently stated at Detroit, by Mr. E. R. Roberts, that nearly 400,000 glower units have been placed in service in the United States for various classes of lighting. Over 100 central stations have adopted and are supplying the lamp on their circuits. The illuminating companies of three cities of over 500,000 population, four cities of over 250,000, three cities of over 100,000, 17 cities of over 25,000, and 17 cities of over 10,000 population have adopted the lamp. Of the total number, about 20 per cent. have seen fit to furnish free renewals, putting the lamp out on a flat rate contract basis.

Electric Smelting.—Before the Staffordshire Iron and Steel Institute at Birmingham recently, a paper on "The Electric Smelting of Iron and Steel" was read by Mr. J. H. Stansbie.

The "Armorl" Electro-Capillary Recorder.—Some time ago we referred to the experiments which were being carried on with this apparatus in connection with submarine telegraphy. The illustration herewith is a reproduction of a message containing



the alphabet, which, we are informed, was received by the recorder over a long submarine cable at the rate of 33·7 five-letter words per minute, though this, it is claimed, does not represent the maximum speed of reception. It will be noticed that the peaks represent "dots" and the hollows "dashes," as indicated by us on the figure, in white. The signals are as clear as could be wished. The apparatus was described in our issue of August 19th last.

Royal Society Medals.—Yesterday's *Times* announced that the Council of the Royal Society had made the following awards of medals for this year:—

The Copley medal to Sir William Crookes, F.R.S., for his long-continued researches in spectroscopic chemistry, on electrical and mechanical phenomena in highly rarefied gases, on radio-active phenomena, and other subjects.

The Rumford medal to Professor Ernest Rutherford, F.R.S., for his researches on radio-activity, particularly for his discovery of the existence and properties of the gaseous emanations from radio-active bodies.

A Royal medal to Professor William Burnside, F.R.S., for his researches in mathematics, particularly in the theory of groups.

The Hughes medal to Mr. Joseph Wilson Swan, for his invention of the electric incandescent lamp, and various improvements in the practical applications of electricity.

Calcium Cyanamide in Italy.—According to the *Frankfurter Zeitung*, a company entitled the "Societa Italiana per la Fabbricazione dei Produtti azotati ed altre Sostanze per l'Agricoltura," has been founded in Milan with a capital of six million lire, to manufacture calcium cyanamide by the Frank process, and also to make sulphuric acid and copper sulphate. The chief promoters of the concern are the Societa Italiana di Ellettrochimica of Rome, Ressi & Co.'s bank in Milan, and the Societa di Assicurazioni Diverse of Naples. For the manufacture of calcium cyanamide, the company will use the patented method belonging to Siemens and Halske. The calcium carbide required is to be obtained from the Societa pel Carburo di Calcio of Terni, and it is expected that some 3,000 tons will be needed per annum.

I.E.E. (Newcastle Section).—The fifth annual dinner of this section was held on 2nd inst., Mr. Eugene Brown (chairman) presiding. Among those present were Mr. R. Kaye Gray, President; Sir Isambard Owen, Principal of the Armstrong College of Science; Mr. G. C. Lloyd, secretary; Mr. S. Z. de Ferranti, Mr. Raworth, Mr. J. H. Holmes, Mr. J. F. C. Snell, the Hon. C. L. Parsons, and Mr. W. D. Hunter.

Mr. C. S. Vesey Brown proposed the toast, "The Mayor and Corporation of Newcastle." Dr. Farquharson and Mr. Thomas Cairns responded. Dr. Farquharson gave "The Institution of Electrical Engineers." In the course of his remarks he said the establishment of the tramway system in Newcastle left little to desire from an electrical point of view. They would, doubtless, sympathise with the reference he wished to make to the late engineer of that system. He had been put under a cloud, deserved or undeserved he was not there to say, but he could only speak by results and knowledge, and he did say as a member of the Corporation that in his intercourse with the late electrical engineer he felt he was associated with a gentleman whose scientific attainments were very great, and whose honest desire to do his very best for the Corporation was at all times above any question.

Mr. R. Kaye Gray, President of the Institution, responded. He dealt principally with the recent visit to America. The Americans, he said, spoke very large. No doubt they spoke from a sound foundation, because anyone engaged in electrical enterprise must know they had done a great deal of very good work indeed; but the success they had obtained, he believed, was due to the fact that they had on the other side of the Atlantic large trusts controlled by men commanding large capital who, whether with good or bad judgement, developed vast enterprises. On this side they had not the same thing to the same extent. They had only to realise the opportunities of the electrical engineer in America, when it was notorious that perhaps one success was bought at the expense of 20 trials and a large expenditure of capital. They on this side had not that opportunity, but he would say this, that when they did put their shoulders to the wheel, they did not want to have 19 failures, but to make sure that, when they did produce something, it should be a development that would tell in the world. His general impression of American methods was that they were exceedingly extravagant. That extravagance was apparent to anyone. He would like to say that he thought that, in this country, they were much wiser to carry on their experiments in a sensible way, and to appropriate the experience of the people on the other side, without paying the expense.

The chairman also responded.

Mr. Ferranti gave "The Durham College of Science," which was responded to by Sir Isambard Owen.

I.E.E. (Glasgow Section).—The session was opened on Tuesday evening, when Mr. Robert Robertson delivered his inaugural address. He said he was a strong advocate of education in its broadest sense in connection with all the scientific professions and industries, and believed that such institutions as theirs were important factors in such education. The membership had shown an improvement during the past year, and although they could not look for a very rapid increase in numbers, owing to the limited field from which their members were drawn, he appealed to them to do all they could to extend the usefulness of the branch in every possible direction. Mr. Robertson afterwards delivered an address on the application of electricity to the coal industry, with special regard to its use for that purpose in the County of Lanark. Referring to the Government Departmental Committee, which had investigated the question and issued a report early in the present year, he said that the Committee in opening the report had stated that they were impressed with the fact that electricity was likely to play an important part in the mining industry of the future. While this inquiry would no doubt be the means of calling attention to the importance of electricity in connection with this industry, it was of the utmost importance, he thought, that no code of rules or legislative enactment should be passed which would in any way trammel or hinder its legitimate development and extension. He thought the Mining Association of Great Britain should have the support of the Institution in so far as its efforts were directed towards that end. There was no doubt whatever that legislation, carefully devised with a view to leaving all freedom compatible with reasonable safety, would do much to help the advancement of the use of electricity in the mining industry, especially among those who were prejudiced against the new power because they were ignorant of its merits, and were unnecessarily alarmed at what they considered its dangers.

Tramways and Light Railways Association.—The *Official Circular* for October contained the paper by Mr. John I. Hall on "Raworth's System of Automatic Regenerative Control." The discussion, and the illustrations to the paper, are given in the *Circular* for November, which also contains some "Notes on Permanent Way," read before the Association on 3rd inst. by Mr. A. N. Connett. On Friday, 11th inst., the members of the Association will visit the works of the L.C.C. tramways by invitation. On Thursday, December 1st, Mr. Stephen Sellon will read a paper on "Running Powers." Mr. A. Baker, president, will take the chair. A paper on "Overhead Equipment" will be read by Mr. Henry M. Sayers in January next.

Society of Arts.—The opening meeting of the one-hundred-and-fifty-first session will be held on the 16th inst., and the list of papers of interest to the profession to be read during the session includes:—Arthur Lee, J.P., "The British Canals Problem"; Charles D. Abel, "The Patent Laws"; Killingworth Hedges, M.Inst.C.E., "The Protection of Buildings from Fire"; Ben. H. Morgan, "The Promotion of British Trade"; James Nelson Shoolbred, B.A., M.Inst. C.E., "The Supply of Electricity."

Appointments Vacant.—Assistant examiners at the Patent Office; mains assistant for Blackburn Corporation (£130); mains superintendent for Poplar (£120); shift engineer for Worksop U.D.C. (25s.). See "Official Notices" to-day.

Association of Engineers-in-Charge.—A paper was read by Mr. W. F. Goodrich on "Economic Steam Generation and Smoke Prevention," at a meeting of this Association on 9th inst.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the power station or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*]

Central Station Engineers.—The Horsham U.D.C. has increased the salary of Mr. Morgan, electrical engineer, from £175 to £225 per annum.

The Faversham Town Council has appointed Mr. Wolf as assistant engineer at the electricity works.

Mr. C. H. Smyth, chief electrical assistant at Willesden, has been provisionally appointed mains superintendent by the Electric Supply Committee of Marylebone Borough Council.

Tramway Officials.—On the retirement of Mr. John Metcalf from the managership of the Gateshead and District Tramways Co., Ltd., a presentation was made to him by the staff and men employed by the company. The presents took the form of a gold hunter watch and engraved silver cigarette case. The chair was taken by Mr. W. Morrison, the managing director, and the presentation was made by Mr. Charlton, secretary of the local Power Supply Co., in the presence of a large audience of the staff, officials and men. Among those present were Mr. Cooper, traffic manager, Newcastle; Mr. Simpson (vice-chairman), manager, Tynemouth; Mr. Wilson, manager, South Shields; Mr. Bettison, manager, Hartlepool; Mr. P. Shannon, of the British Electric Traction Co.; and many personal and business friends of the recipient. Mr. Metcalf having suitably replied, a smoking concert was proceeded with.

As already announced, the Blackburn T.C. has resolved to separate the management of the tramways undertaking from that of the electricity undertaking, and has appointed Mr. J. H. Cowell, traffic manager, and Mr. L. Johnston, assistant tramway engineer, as joint managers of the tramways. Each gentleman will receive a salary of £250 per annum. Mr. P. P. Wheelwright, chief assistant electrical engineer, becomes electrical engineer and manager of the electricity department, at a salary of £300 per annum; and the salary of Mr. F. H. Corson, electricity station superintendent, has been increased to £250 a year.

Mr. D. M. Kinghorn, electrical engineer and manager to the Leigh Corporation, was on Wednesday appointed chief engineer and manager to the Southwark Borough Council's electrical undertaking. There were 93 candidates.

General.—In connection with the Glasgow municipal elections on Tuesday last week, considerable surprise was occasioned by the defeat of ex-Bailie Paton, the "perpetual" chairman of the Corporation tramways. Mr. Paton, who has been a member of the Town Council for exactly 20 years without interruption, has been at the head of the Tramways Committee since the Corporation took over the car service in the city. So successful was he in this capacity, that the Town Council, contrary to the general practice, appointed him, year after year, convener of the Committee. He took a prominent part in the work of converting the system from horse haulage to electric traction, and the success of the undertaking has been, in a great measure, due to his zealous care and enterprise. During the present election it was one of his boasts that he had given more attention to the tramways department of the Corporation than he had done to his own business. Mr. Paton was known throughout the country in connection with the Glasgow tramway cars. His defeat has caused considerable regret amongst the members of the Town Council, with whom he was held in the highest respect.

Councillor Hugh Alexander has been appointed convener of the Glasgow Corporation Tramways Committee, in room of ex-Bailie Paton.

The vacancy on the board of the Notting Hill Electric Lighting Co., Ltd., caused by the death of Mr. W. H. Willans, J.P., D.L., has been filled by the election of Mr. Richard Biddulph Martin, M.P.

For the post of resident engineer for the electrical tramways and generating station at Pontypridd, 86 applications have been received, and the U.D.C. has selected the following to appear before them:—Mr. Leopold de Verge, deputy borough electrical engineer, Newport; Mr. J. C. Whitley, deputy tramways manager and engineer at Huddersfield; Mr. C. E. Stewart Bill, in charge of the overhead equipment at Leicester; Mr. J. E. Teasdale, chief electric light and tramways assistant at Cardiff; Mr. D. A. Hamilton, chief assistant electrical and tramways engineer at Lancaster; Mr. C. H. J. Anderson, resident engineer to the Merthyr Electric Traction and Lighting Co., Ltd.; Mr. John Senior, resident electrical engineer to the Mexborough U.D.C. The salary is £300 a year.

A representative gathering of the engineering, commercial, and postal staffs of the South Wales District of the G.P.O. took place at Gloucester last Saturday week, when several presentations were made to Mr. C. A. Smith, first-class sectional engineer, upon his retirement after 41 years' service. Mr. Vyle (superintendent engineer of the district) occupied the chair. The South Wales district engineering branch, and others, presented to Mr. Smith a gold keyless watch, and the construction staff a photograph of the recipient. Mr. Smith, in acknowledging, took the opportunity of giving a welcome to his successor (Mr. Bennett, of Norwich).

Mr. J. E. Neale, senior partner of the Torque Electrical Engineering Co., is at present in Cape Town, superintending the erection of the plant for the Cape Town Exhibition, the contract for which was obtained by his firm. He is also opening permanent branches in Cape Town and Johannesburg, and any communications relating to South African business can be addressed to the head office, Dalling Road, Hammersmith, or to the Torque Electrical Engineering Co., 93, St. Georges Street, Cape Town.

NEW COMPANIES REGISTERED.

Aster, Ltd. (82,337).—This company was registered on October 20th, with a capital of £25,000 in £1 shares (5,000 preference), to acquire the undertaking of the Begbie Manufacturing Co., Ltd., or any part thereof, and to acquire all or any of the assets of Société L'Aster, a société anonyme registered in France, to adopt agreements with the said company and société, and to carry on the business of mechanical engineers, electricians, gas, oil and electric engine and motor manufacturers and dealers, machinists, fitters, millwrights, founders, wire drawers, &c. The first subscribers (each with one share) are:—A. Firth, 407, Oxford Street, W., gentleman; S. D. Begbie, 407, Oxford Street, W., engineer; H. Cheronnet, 104, Rue de Courcelles, Paris, ingenieur des arts et manufactures; A. Monard, 65, Rue Michel Ange, Paris, ingenieur des arts et manufactures; Mrs. E. Clench, The White House, Harlesden; Mrs. M. Begbie, The White House, Harlesden; and A. Dobson, 407, Oxford Street, W., secretary. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are H. Cheronnet, A. Firth, A. Monard and S. D. Begbie; qualification, £100; remuneration, £400 per annum, divisible. Registered office, 407, Oxford Street, W.

Patents and Industries, Ltd. (82,426).—This company was registered on October 29th, with a capital of £1,000 in £1 shares, to carry on the business of electrical engineers and experts, technical advisers, consulting and mechanical engineers, contractors, ironfounders, machinists, &c. The first subscribers (each with one share) are:—G. L. West, 10, Serjeant's Inn, E.C., clerk; A. F. Sims, 16, Serjeant's Inn, E.C., solicitor; S. King, 192, Fleet Street, E.C., stationer; S. S. Heath, 192, Fleet Street, E.C., stationer; J. W. A. Wymark, 149, Kennington Road, S.E.; J. Irwin, 128, Charterhouse Street, E.C., clerk; and R. Leach, 10, Serjeant's Inn, E.C., solicitor. No initial public issue. The subscribers are to appoint the first directors; qualification, 50 shares: remuneration, 5 per cent. of the net profits, divisible. Registered office, 10, Serjeant's Inn, Fleet Street, E.C.

Raworth's Traction Patents, Ltd. (82,432).—This company was registered on October 31st, with a capital of £30,000 in £1 shares, to acquire from J. S. Raworth, of 2, Queen Anne's Gate, Westminster, certain patents and inventions connected with electrical or mechanical traction, and to carry on the business of manufacturers of electrical cars, electric plant and accessories, constructors and owners of railways and tramways, &c. The first subscribers are:—J. S. Raworth, Queen Anne's Gate, Westminster, civil engineer, 400 shares; T. Browell, 6, Old Queen Street, S.W., engineer, 100 shares; C. S. Hilton, 41, Roland Gardens, S.W., gentleman, 200 shares; G. F. Metzger, 3, York Street, Manchester, engineer, 125 shares; A. K. Baylor, Trafford Park, Manchester, electrical engineer, 125 shares; J. I. Hall, 82, Durlston Road, Kingston-on-Thames, electrical engineer, 25 shares; and D. Macdonald, 9, Palace Road, Streatham Hill, S.W., gentleman, 25 shares. Minimum cash subscription, one-third of the shares offered to the public. The subscribers are to appoint the first directors; qualification, 1 share; remuneration, £50 each per annum (£100 for the chairman), and 5 per cent. of the distributed profits, divisible. Registered office, 2, Queen Anne's Gate, Westminster.

Immisch Launch and Boat Co., Ltd. (82,454).—This company was registered on November 2nd, with a capital of £10,000 in £1 shares, to acquire from the Immisch Electric Launch Co., Ltd., their electric launches, boats, charging stations, property and undertaking, and to carry on the business of electrical and mechanical engineers, electricians, contractors, &c. The first subscribers (each with one share) are:—C. L. Robertson, 14, Vicarage Gardens, Kensington, W., gentleman; S. R. Booth, 30, Norfolk Street, W.C., secretary; W. S. Wreathall, 30, Norfolk Street, W.C., secretary; H. S. Parnell, 97, Oakley Street, Chelsea, S.W., journalist; S. Humphry, Foxton House, Royston, Cambs., gentleman; W. F. Herring, 35, Hawarden Grove, Herne Hill, S.E., secretary: and W. Rumball, St. Albans, New Malden, surveyor and valuer. No initial public issue. The subscribers are to appoint the first directors; qualification, one share; remuneration as fixed by the company. Registered office, Donington House, Norfolk Street, W.C.

Traction Corporation, Ltd. (82,477).—This company was registered on November 4th, with a capital of £100 in £1 shares, to acquire any patents and rights relating to the production, treatment, storage and use of any motive or mechanical power and any apparatus therefor, and to carry on the business of manufacturers of and dealers in tramcars, carriages, motor-cars, trucks, vehicles, locomotives, accumulators, dynamos and machinery, suppliers of electrical, water, air or other power, &c. The first subscribers (each with one share) are:—J. D. McAra, 16, Great George Street, S.W., secretary; E. G. Quest, 116, Fore Street, E.C., clerk; V. F. Crowther-Smith, 6, Stone Buildings, W.C., solicitor; D. T. Reid, 30, Regent Square, King's Cross, W.C., clerk; E. P. Bainbridge, 69, Ennismore Gardens, S.W., gentleman; R. Brown, 16, Great George Street, S.W., engineer; and R. Simpson, 1, Brick Court, Temple, E.C., barrister. No initial public issue. Table "A" mainly applies.

W. & E. Sumner, Ltd. (82,446).—This company was registered on November 1st, with a capital of £1,000 in £1 shares, to carry on the business of mechanical and electrical engineers, patentees and manufacturers of and dealers in electrical appliances and other articles, general merchants, importers, exporters, brokers, factors, commission agents, &c. The first subscribers (each with one share) are:—Mrs. H. S. Sumner, 45, Litherland Park, Litherland, Liverpool; F. A. Pocklington, 53, Castle Street, Liverpool, electrical engineer; T. Williams, 34, Rockville Street, Rock Ferry, Birkenhead, clerk; W. S. Deyes, 27, Ashfield, Wavertree, Liverpool, accountant; Miss N. Harrop, 255, Liscard Road, Liscard; J. H. Glover, 60, Castle Street, Liverpool, solicitor; and J. A. Watson, 78, Fountain Street, Birkenhead, clerk. No initial public issue. Table "A" mainly applies.

ELECTRICITY SUPPLY ACCOUNTS.

Kirkcaldy Municipal Electricity Supply and Tramways.

The returns of this Scottish borough are for the first completed year's working of both the lighting and tramway departments.

In the case of the electric supply, a promising start has been made, aided, no doubt, by very substantial traction and public lighing loads, which it will be seen in both cases, exceed the private supply; it is also a matter for congratulation that after meeting the current year's financial charges, a surplus remains which all but covers the deficit of the first few months' working.]

The prices charged are:—Private lighting, 4½d. per unit; power, 2½d., and traction, 2d., flat rates; public arcs, £16 per annum. The chief engineer is Mr. O. F. Francis.

General Statement for Year ending May 15th, 1904.

Total capital expended	£52,578
Number of units sold—	
Private supply	67,555
Public lighting	87,039
Traction	395,071
Total number of units sold	549,665
Equivalent number of 8-c.p. lamps connected	40,000 (app.)
H.P. of motors connected	50
Number of public lamps	104 10-a. arc 2081 6 c.p. inc.
Maximum load in kw.	475 kw.

Revenue Account.

Gross revenue	£5,367 =	2·35d. per unit.
Works and distribution costs (inc. pub. lighting)	£2,188 =	·95d. per unit.
Total working costs	£3,105 =	1·35d. per unit.
Gross profit	£2,262	

Average price obtained per unit—

Private lighting	5·25d.
„ motors	2·4d.
Public lighting	3·02d.
Traction	1·75d.

Profit Statement.

Interest on loans	£1,334
Sinking fund	564
Debit balance carried forward	— 42
Deficit brought forward from last account ...	406
Gross profit	£2,262

TRAMWAYS ACCOUNTS.

For 12 months ending May 15th, 1904.

Length of route	5 miles
Total length of track	7½ „
Car-miles run	301,779
Passengers carried	2,770,936
Capital expended to date	£78,731
Traffic receipts	£9,934
Total receipts	£10,189
Working expenses	£7,623
Gross profit	£2,566
Income per car-mile	8·10d.
Working expenses per car-mile	6·05d.
Interest and sinking fund per car-mile ...	1·98d.
Total expenses per car-mile	8·03d.
Profit or loss per car-mile	+ 07d.
Cost of energy per car-mile	2·29d.
Average fare per passenger	·86d.
Revenue per mile of route	£2,038
Expenditure per mile of route	£1,525
Total units used	395,071
Units used per car-mile	1·309
Percentage of working expenses to receipts ...	75·5%

In regard to the tramways, one route only was in use until December, and the returns are, therefore, not representative of a complete year on the whole system. However, although the average income is not up to the level of larger undertakings, yet under the influence of moderate working expenses, the department contrives to show a surplus after meeting all financial charges. Out of the surplus, a sum of £40 was voted to depreciation.

Profit Statement.

Interest on loans	£2,012
Sinking fund	470
Surplus	91
By balance from last account	— 7
Gross profit	£2,566

CITY NOTES.

The Amazon Telegraph Co.

The annual meeting was held on Tuesday at the offices, 42, Old Broad Street. A representative of the Electrical Review was informed that the proceedings were private, and a request for a copy of the report was refused. We are able to state, however, that the directors' report for the year ended June 30th last says that the gross revenue amounts to £53,798, and the total working expenses to £44,042, to which are added £7,361 for interest on loans, and £9,525 for debenture interest and sinking fund, making a deficit of £7,130 for the year, and this, added to the debit balance of £106,181 brought forward from the last account, leaves £113,311 to the debit of the revenue account.

The traffic receipts amount to £40,551, as compared with £34,527 for the previous year, and the approval of the Federal Government has been obtained for an increase of rates, to come into force January 1st next, which, it is hoped, will materially increase the revenue of the company. Amongst the items detailed on the debtor side of the revenue account are the following:—Maintenance of cables, £26,520; directors' fees (including managing director), £750; debenture trustees' fees, £157; Rio de Janeiro agency, £1,890. The traffic receipts are augmented by subsidiary payment from the Federal Government of £13,246. In the balance-sheet we find the share capital to be £250,000; debenture capital, £119,700; total capital, £369,700. There is a debenture sinking fund of £21,525; debenture interest, unpaid, £29,925, and loans of £145,250, secured upon 750 5 per cent. and 1,500 6 per cent. debentures of £100 each. On the asset side we notice:—ss. *Viking* fund of £41,000, State of Amazon 5 per cent. gold bonds for £45,987, and an account for messages due from the Brazilian Government (it is not stated how long outstanding) for £10,083, and sundry other small debtors, leaving, as before stated, a balance to the bad of £113,311. In the early years of the life of this company, we have had occasion to write about its financial condition, and the fairness of our remarks has been proved by results. We fear that if the "maintenance" bill, chiefly, be not materially reduced, there seems little hope of reaching prosperity. The reduction, rather than the increase, of rates seems to have proved elsewhere the most remunerative policy in the end.

Rosario Electric Co.

At the meeting held on 7th inst., at River Plate House, E.C., Mr. W. T. Western, the chairman, said that the new engines and cables had been taken over in August, 1903. After deducting the running expenses in Argentina, the profit for the first six months of 1903, amounted to £2,700, and for the six months to December 31st, 1903, they had risen to £2,800, while for the six months to June 30th, 1904, they had advanced to £5,160. For the first two months of the company's current financial year the figure was over £2,400. The number of customers had risen from 800 in December, 1903, to 936 in September last. Besides taking on new consumers for lighting, the company had made a beginning in the power business. The report was adopted.

A resolution was then passed to increase the capital to £160,000 by the creation of 8,000 further 6 per cent. cum. pref. shares of £5 each, ranking *pari passu* with the existing pref. shares. The time had now come when the directors were not afraid of paying interim dividends. In future, therefore, half-yearly dividends would be paid.

The resolution was carried.

The British Aluminium Co.

An extraordinary general meeting was held at Winchester House, E.C., on Wednesday, for the purpose of considering the following special resolutions:—

(1) That each of the existing "A" cumulative preference shares and each of the 7 per cent. cumulative preference shares of £10 each be divided into two shares of £5 upon each of which the sum of £5 shall be credited as paid up; (2) That the 10,000 ordinary shares of £1 each be consolidated in such manner that every five of the existing shares shall constitute one £5 share upon which the sum of £5 shall be credited as having been paid up; (3) That the existing articles of association of the company be cancelled, and that the articles contained in the printed document submitted to the meeting and for the purpose of identification subscribed by the chairman thereof be and the same are hereby approved and that such articles be and they are hereby adopted as the regulations of the company to the exclusion of all existing regulations thereof.

Mr. J. D. Bonner, who presided, in moving the adoption of the resolutions, said that at the last meeting of the company, the chairman explained that the board felt that the time had arrived to take the necessary steps for the development of the Loch Leven water power, and he stated that later in the year proposals for the raising of the necessary capital would be submitted. It was as a preliminary to bringing these proposals before the shareholders that they asked for the resolutions to be passed. When the confirmatory meeting was held they would be in a better position to explain their proposals. The effect of the first two resolutions would be that each £5 of share capital would have one vote. It did not affect in any other way the respective rights of the different classes of shares. He felt, however, that £5 shares were more popular and more marketable than £10 shares, and he had no doubt that they would unanimously approve of the restoration of the shares to one uniform denomination. The third resolution appeared on the face of it to be of a more important character; but, as a matter of fact, the proposed new articles were in the common form. The company appeared to be entering on a more prosperous period than it had ever yet enjoyed, and he felt confident they would endorse the idea of bringing the articles up to date.

Mr. Wolfenden seconded the motion.

Replying to questions, Mr. Bristowe (the solicitor) said there were no material alterations in the new articles of association. The fact was that their articles had been so patched, and they had to consult so many documents when they wanted to find a point, that they were taking the opportunity of consolidating them.

The resolutions were carried.

North-Western Electricity and Power Gas Co.

A meeting of this company was held at Crewe, on 21st ult., Mr. T. W. Twyford, of Hanley, occupying the chair.

The Chairman explained at some length the position of the company, and said that other companies having objects similar to those of this company were making satisfactory progress, notably the South Wales Electric Power Co. It was decided to increase the capital of the company with a view to paying off the liabilities incurred in obtaining the two Acts of Parliament, and to provide funds for laying down plant at some convenient place in the Potteries in order that the practicability of utilising Mond gas for firing ovens might be demonstrated to those interested in the pottery and kindred trades. A sum of nearly £6,000 was promised in the room.

Mr. T. W. Harrison, a shareholder, expressed the opinion that to ensure local support this plant should be put down at once to demonstrate the advantage to be derived by the use of Mond gas for firing purposes.

When this has been done and the financial market is favourable, says a Stafford paper, it is the intention of the company to appeal to the public for the capital necessary to construct and equip their first power station, which will be erected in the neighbourhood of Milton.

Eastern Extension Telegraph Co.

The report for the half-year ended June 30th last, to be submitted to the meeting on the 16th inst., states that the gross receipts have amounted to £300,058, against £265,099 for the corresponding half of 1903. In the former figure is included interest on investments (£13,125), which in the corresponding period of 1903 was carried direct to the general reserve fund. Working expenses, including £25,712 for maintenance of cables, absorb £141,707, against £138 516 for the corresponding period of 1903, leaving a balance of £158,350. From this is deducted £2,923 for income-tax and £12,048 for interest on debenture stock, leaving £143,379 as net profit for the half-year. After adding £41,891 brought forward, there is an available balance of £185,270. Two quarterly dividends of 1½ per cent. each have been paid, leaving £110,270 to be carried forward. A further partial renewal of the Hong Kong-Foochow cable has been effected, and the cost, amounting to £6,273, charged against the general reserve fund. The ss. *Restorer* has been sold to replace the Commercial Pacific Cable Co.'s ss. *Scotia*, and a small steamer (ss. *Magnet*) has been purchased for effecting repairs to the many cables which the company possesses in shallow waters of less than 400 fathoms. The subsidy arrangement in connection with the Tonquin cable expired in February last, and a new agreement has since been arranged, subject to Parliamentary approval, by which the French Government will acquire the ownership of the cable.

Cape Electric Tramways, Ltd.

The report for the year ended June 30th last, to be presented at the meeting on the 23rd inst., shows, after providing for debenture interest and redemption of debentures, a net balance to credit of £57,080. Two interim dividends of 5 per cent. have been paid. The reserve fund has been credited with £8,000, leaving a balance of £793 to be carried forward. The passenger and revenue returns for the Cape Town system for the 12 months under review both show a slight increase over the previous year, and the expenditure account a small decrease over the same period. An increase of passengers and revenue has also been experienced in Port Elizabeth; but, on the other hand, the expenditure account of that system has had to bear several very heavy charges during the past 12 months, due principally to the necessity for constructive repairs to the permanent way, to a serious increase in the coal account, and to other special items, amounting in all to about £6,000.

Electricity Supply Company for Spain.—Notice is given that the third drawing of the 5 per cent. consolidated debentures for redemption at par on January 2nd, 1905, will take place at the registered office of the company, College Hill Chambers, College Hill, E.C., on Monday, November 21st, 1904, at 11.30 a.m.

Prospectus.—*The Kalgoorlie Electric Tramways, Ltd.*, has been before the public this week with £75,000—5 per cent. first mortgage debenture stock at par. The stock was offered by the Tramways Syndicate, Ltd., and the list was to close on Wednesday.

Bordeaux Electric Tramways.—The directors of the Compagnie Francaise des Tramways Electriques et Omnibus de Bordeaux have declared a dividend for the half-year ended June 30th, 1904, payable on November 15th, 1904, as follows:—4.80 fr. on registered shares by endorsement on certificate; 4.65 fr. on bearer shares against coupon No. 6.

Rhodes Electrical Manufacturing Co.—The directors have declared an interim dividend for the quarter ending August 31st, 1904, at the rate of 6 per cent. per annum on the ordinary shares.

STOCKS AND SHARES

Wednesday Evening.

War's alarms are growing fainter in the Stock Exchange, where prices have begun to recover from their recent weakness. The prospect, too, of a 4 per cent. Bank Rate has been robbed of its terror by much discussion and anticipation. New Russian and Japanese External loans are pending, but the bonds of the former country will not be offered here, and another ten millions sterling Japanese issue would not hurt the money market in Lombard Street. Industrial descriptions have taken a step forward in public favour, and electrical varieties as a whole are better on the week.

Not for the last decade has there been so many changes to report at one time in the following price lists as there are to-day. The Stock Exchange Committee have tardily awakened to the fact which has been patent for years past, that the *Official List* quotations are what we have continually termed ridiculously wide. Business is being lost to the Stock Exchange every day by the absurdity of the system that permits the official limits between buying and selling prices to be far wider than those which prevail upon an actual dealing basis. The folly of the thing does not seem to have dawned upon the Committee until last week, but their instructions that prices should be quoted at narrower margins are responsible for nearly all the changes just referred to. The middle price in many cases remains unchanged; the alteration occurs in the fractions on either side of that middle price, and in cordially welcoming a reform that we have for years declared to be necessary, a hope may be added that the system will extend still more; there is certainly plenty of scope for it even yet.

After this, it seems like an anti-climax to say that Central London Deferred stock is now quoted at 83 to 86, or 1 per cent. wider than it was last week. The reason for this, however, lies in the lack of market in Central London, upon which we commented a week or two back. It is difficult to see why the company's Ordinary stock should be called 91 to 94, when the actual price is more like 92½ to 93½. City and South London has declined to 46½, a fall of 1½, and Waterloo and City is a trifle better upon the narrowing of the quotation. Metropolitan Consolidated rose to 101, and Districts show a slight advance at 42. The District Co. will discontinue the issue of season tickets after the end of this year.

Examination of the electric supply share list will show that the narrowing of prices is mainly in favour of holders, where it has not stopped at leaving the medium quotation unchanged. For instance, City of London Preference are now 13½—14, instead of being 13—14, Urban Ordinary 4⅞—5, instead of 4¾—5, and so on. There are one or two exceptions, of which County Ordinary and Notting Hill are examples. The changes in the Debenture stocks, as might have been expected, are nearly all in the upward direction, the improvements being mainly confined to rises of a point in the selling prices.

The Kalgoorlie Electric Tramways Debenture issue has been received with a certain amount of kindliness, although, of course, the great thing against the company is the uncertainty attaching to the gold industry in Western Australia. A town may be exceedingly prosperous for a certain number of years and then drop to the level of a deserted village if the chief industry "pinches out." Kalgoorlie, of course, is not wholly dependent upon gold mining, but it owes the greater part of its *raison d'être* to the search for the metal, and Westralian companies are notoriously "pocketty." Beyond this, the issue looks a fair risk of its kind.

Telegraph descriptions have been altered in wholesale fashion. The Eastern Telegraph price has only three points difference between its buying and selling margins, whereas last week it was five points. When a broker comes to deal he expects to get a 1¼ per cent. price, or, at the widest, 2 per cent., so there is room for further pruning. The middle price remains at 134½, and Eastern Extensions are still 12⅝. Anglo-American Telegraphs have advanced very sharply, the Deferred being 1⅜ up at 9½ upon a fresh access of speculative buying. National Telephone stocks and shares are rather better, and Chili Telephones at 5¾ are ¼ higher. Monte Video shares find supporters at 12s. 6d.

Traction issues are steady, without much change. Isle of Thanet Electric Tramways 4 per cent. Debenture stock has crept up to 92½, Auckland 5 per cent. Debenture is better at 106, and Calcutta Tramways 4½ per cent. Debenture changes hands about 108. British Columbia Preferred is 103½, the Deferred being about a point more. In the Miscellaneous section, Brush shares are nominally lower, and the Second Debenture has dropped to 70½. At 3⅝ Westinghouse Preference have receded a fraction.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1901.	1902.	1903.	Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Business done week ended Nov. 9th, 1904. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	98 —102	99 —102	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2⅛ — 8⅛	2⅛ — 8	..	..
119,700‡	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	.. — ..	.. — ..	..	..
788,840	Anglo-American Telegraph	Stock	61s.	60/6	61s.	50 — 53	52 — 54	52	50⅜
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	97 — 99	99 — 102	99	98½
3,105,580	Do. do. do. Deferred	Stock	2s.	1/-	2s.	8½ — 8⅝	9⅜ — 10	9⅜	8½
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	5 %	7 %	5⅛ — 5⅜	5⅛ — 5⅞	5⅜	5⅛
18,333,300‖	Commercial Cable	$100	8 %	8 %	..	170 —190	170 —190	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	93 — 96	93 — 96	93¼	..
16,000	Cuba Telegraph	10	4 %	6½%	5 %	7 — 8 xd	7⅛ — 7⅜	..	..
6,000	Do. 10 % Pref.	10	..	..	..	14⅛ — 15⅛xd	14⅛ — 15⅛	..	..
6,000	Direct Spanish Telegraph 10 % Cum. Pref.	5	..	..	..	7 — 8	7⅛ — 7⅜	..	..
80,000	Do. do. 4½ % Debs.	50	..	..	..	98 —101 %	99 —101	..	..
60,710‡	Direct United States Cable	20	3½%	3½%	3 %	10½ — 10⅝	10⅝ — 10⅝	10 1/16	10⅛
81,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,900, Red.	100	..	..	..	100 —102	100 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	132 —137	133 —136	135	132½
1,955,555	Do. 8½ % Pref. Stock	100	..	..	..	86 — 89	88 — 90	89½	87½
1,584,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	104 —107 xd	105 —107	..	..
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	12½ — 13	12⅝ — 12⅝	12⅞	12⅝
800,000‡	Do. 4 % Deb. Stock	Stock	..	..	..	105 —108	106 —108	..	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1908	100	..	..	..	100 —108	101 —101	..	..
800,000‡	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102 xd	100 —102	..	..
180,227	Globe Telegraph and Trust	10	5½%	£3 16 7*	5½%	9½ — 9⅝xd	9⅝ — 9⅞	9⅞	9½
180,042	Do. do. 6 % Pref.	10	..	..	..	13¾ — 14	13⅝ — 13¾	13⅝	13⅜
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	12½%	15 %	28½ — 29½	28½ — 29	28¼	..
54,700	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	100 —102	100 —102	..	..
17,000	Indo-European Telegraph	25	10 %	10%	10 %	44 — 47 xd	44½ — 46½	44½	..
72,680	Monte Video Telephone Co., Ltd., Ord.	1	2½%	3 %	3 %	⅞ — 1 1/16 xd	⅞ — 1 1/16	..	..
1,993,333	National Telephone, Pref. Stock	100	5 %	6 %	6 %	106 —108	106½ —107½	107½	106½
1,966,667	Do. do. Def. Stock	100	..	4½%	5 %	96 — 98	97 — 98	97½	97
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	13 — 14	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	12 — 13	12½	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5 1/16	..
000,000‡	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97 — 99	97⅛ — 98½	98	97
689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	104 —106	104½ —105½	..	..
1,000,000	Do. do. Prov. Certs., 35 % to be paid	..	..	..	..	67 — 69	67⅝ — 68½	..	..
179,318	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	6½%	1⅛ — 1 1/16	1⅛ — 1 1/16	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	..	..	1⅛ — 1⅛xd	1⅛ — 1⅛	..	..
100,000‡	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	98 —100	..	..
11,899	Reuter's	8	5 %	5 %	..	6½ — 7½	6⅝ — 7½	11⅞	..
8,808	Submarine Cables Trust	Cert.	..	..	..	117 —122	118 —121	..	..
68,000	United River Plate Telephone	5	7 %	7 %	..	6⅛ — 6⅜	6⅜ — 6⅜	..	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..
179,947‡	Do. do. 5 % Debs.	Stock	..	..	..	103 —106	104 —106	103½	..
15,609	West African Telegraph, Shares	10	..	2 %	4 %	6⅞ — 7⅛	7 — 7⅜	..	..
30,008	West Coast of America, 1 to 30,000 and 53,001 to 53,008	2½	..	..	..	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..
150,000‡	West Coast of America, 4% Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	..	..	..	97 —100	98 —100	..	..
267,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	12½ — 13	13 — 13⅛	13⅛	12⅝
75,000‡	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	101 —104	101⅛ —103⅛	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	101 —104	101⅛ —103⅛	102	..
88,221	West India and Panama Telegraph	10	..	..	..	1⅝ — 1¾	1 15/16 — 1 15/16	1 15/16	..
84,568	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6¼ — 7	6¼ — 7⅛	7 1/16	6 15/16
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	5 — 6	5⅛ — 5⅛	5⅝	..
80,000‡	Do. do. do. 5 % Debs., Nos. 1 to 1,600	100	..	..	..	100 —103	101 —103	102	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	5⅛ — 6	5⅜ — 6	..	..
10,000	Do. do. "A" 6 % Cum. Pref.	10	..	..	..	8⅛ — 9⅛	8⅛ — 9⅛	..	..
800,000‡	Do. do. 5% 1st Mort. Deb. Stock Red.	Stock	..	..	..	96 — 100	96 —100	..	..
100,000	British Electric Traction	10	9 %	8 %	..	9⅜ — 10⅛	9⅜ — 10⅛	10⅛	10 1/16
100,000	Do. do 6 % Cum. Pref.	10	..	..	..	11 — 11⅛	11⅛ — 11⅜	11 1/16	11 1/16
600,000‡	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	116 —119	117 —119	118⅛	117⅜
	Do. do. 4½% 2nd Deb. Stock Red.	100	..	..	..	94 — 97	95 — 97	96⅜	95⅜
100,000	British Insulated and Helsby Cables	5	10 %	10 %	8 %	5⅜ — 6	5⅜ — 6	..	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5⅜ — 6	5⅜ — 6	..	..
60,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	101 —104	101 —104	..	..
60,000	¶Brownett, Lindley & Co., Ord.	£1	Nil	..	..	1/16 — 1/8	1/16 — 1/8	..	..
60,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	..	..	14/6 to 15/6	14/6 to 15/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	¼ — ⅜	¼ — ⅜	⅜	..
150,000	Do. do. Non-cum. 6 % Pref.	2	3 %	6 %	6 %	1 — 1⅛	1 — 1⅛	1⅛	1 1/16
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	98 — 96	98 — 96	..	..
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	70 — 75	69 — 73	73	72½
85,000	Callender's Cable Construction shares	5	20 %	15 %	12½%	9 — 10 xd	9⅛ — 9⅞	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	5	..
90,000‡	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	103 —106	104 —106	..	..
1,860,014	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	91 — 94	91 — 94	93⅜	92⅜
494,098	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	100 —102	100 —102	..	..
494,998	Do. do. Def. do.	Stock	4 %	4 %	4 %	81 — 83	83 — 86	..	..
1,330,000	City and South London Railway	Stock	2 %	3½%	2¾%	47 — 49	46 — 47	47	46
85,000	Crompton & Co., Nos. 1 to 85,000	8	7½%	5 %	..	1½ — 2	1½ — 2	..	..
100,000‡	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	90 — 95	90 — 95	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £8 paid, 1 to 99,261	5	Nil	Nil	..	½ — ⅝	½ — ⅝	..	..
17,189	Do. do. "A" shares, 01—017,189	5	Nil	Nil	..	1 — 2	1 — 1½	..	..
44,023‡	Do. do. 4 % Deb. Stock Red.	100	..	..	..	78 — 83	78 — 83	..	..
100,000‡	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	79 — 84	79 — 84	..	..
112,100	Electric Construction 1 to 112,100	25	6 %	6 %	4½%	1 — 1½	1 — 1½	..	..
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	..	..	..	2 — 2⅛	2 — 2⅛	..	..
82,500‡	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100	98 —100	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	9½ — 9⅝	9 9⅛ — 10	9 9/16	9⅜
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	91 — 96	91 — 96	..	..
200,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	15 %	10½ — 11½	10⅜ — 11½	..	..
200,000	Do. do. 4½ % Pref.	5	..	..	..	5 — 5⅛	5⅛ — 5⅜	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	108 —111	109 —111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	19½ — 20½	20 — 20½	20⅛	20
900,000‡	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	99 —102	99 —102	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1½%	..	3⅜ — 3⅝	3⅜ — 3⅝	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10 — 10½	10 — 10½	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	20 %	36 — 39	37 — 39	38½	..
150,000‡	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	101 —104	102 —104	..	..
540,000‡	Waterloo & City Railway, Ord. Stock	100	3 %	3½%	3½%	87 — 90	88 — 90	88	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (April 21st, 1904).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*). – ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years 1901.	1902.	1903.	Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Business done week ended Nov. 9th, 1904. Highest.	Lowest
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	†	8%	8 %	10 %	10½ — 11	10½ — 11	..	..
20,000	Do. do. 7 % Cum. Pref. ..	5	..	..	..	10½ — 10¾	10½ — 10¾	..	..
250,000	Central Electric Supply 4 % Guar. Deb. Stock	5	..	..	..	106 —109	106 —109	..	..
50,000	Charing Cross and Strand Electricity Supply	100	..	..	..	..	..	..	..
70,000	Do. do. do. 4½% Cum. Pref. ..	5	10 %	10 %	8 %	8½ — 9	8¼ — 9	8⅛	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref. ..	5	..	..	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	5⅛
40,000	Do. do. 1903	5	..	..	..	4½ — 5	4½ — 5	..	..
250,000	Do. do. 4 % Deb. Stock Red.	5	..	..	..	4½ — 5	4½ — 5	..	..
44,436	*Chelsea Electricity Supply, Ord.	100	..	..	..	103 —105	103 —105	..	..
150,000‡	Do. do. % Deb. Stock Red.	5	4 %	4¼%	5⅛%	6¼ — 7	6¼ — 6⅝	6⅛	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	Stock	..	..	..	108 —111	109 —111	..	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	5 %	5 %	5 %	10½ — 11	10½ — 11	10⅝	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid ..	10	..	..	..	12 — 14	12¼ — 14	13⅛	18⅜
200,000‡	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid ..	..	..	..	..	122 —126	123 —127	124	..
40,000	County of London Electric Lighting, Ord. 1—40,000	100	..	..	..	103 —106	104 —106	104½	..
20,000	Do. do. do. 6 % Pref., 40,001—60 ..	10	4 %	4 %	4 %	9 — 10	9 — 9½	9¼	..
400,000‡	Do. do. 4½% Deb. Stock	10	..	..	..	11¾ — 12¼	12 — 12½	12¼	12¼
250,000	Do. do. do. 4½% 2nd Deb. Stock	..	..	..	..	106 —109	106 —109	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares	Stock	..	..	..	100 —103 xd	101 —103	..	..
70,000	Do. do. 6 % Cum. Pref.	5	7 %	7 %	7 %	6⅞ — 6⅞	6¾ — 6⅞	6⅞	6¾
300,000‡	Do. do. 4½% 1st Mort. Deb. Stock ..	..	..	..	..	5⅞ — 6⅛ xd	5⅞ — 6⅛	6⅛	5⅞
21,000	Kensington and Knightsbridge Electric Ord.	100	..	..	..	106 —109	106 —106	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	5	10 %	10 %	12%	12 — 13	12 — 13	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	Stock	..	..	..	101 —104	102 —104	102	..
49,840	Do. do. do. 6 % Pref.	8	..	..	..	2 — 2¼	2 — 2¼	..	..
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	5	..	..	..	5¾ — 6	5⅝ — 5⅝	5⅛	..
100,000	Metropolitan Electric Supply, 1 to 100,000	Stock	..	..	..	96 — 99	97 — 99	..	..
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid ..	10	6¾	7¾	8¾	15¾ — 16¼	15¾ — 16¼	16⅜	16
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	5	..	..	..	5¾ — 5¾	5⅝ — 5⅝	5⅝	5⅝
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	..	..	..	..	112 —117	112 —117	114½	..
10,852	Notting Hill Electric Lighting	Stock	..	..	..	96 — 99	97 — 99	97½	..
59,000	Do. do. 4% 1st Mort. Deb.	10	6 %	6 %	6 %	14½ — 15½	14½ — 15	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	100	..	..	..	99 —102	101 —103	..	..
20,000	Do. do. do. 7 % Pref. 20,001 to 40,000	5	14½%	14½%	14½%	14 — 15	14½ — 14¾	14⅝	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	5	..	..	..	8 — 9	8¾ — 9	..	..
12,000	Smithfield Markets Electric Supply, Ord.	100	..	..	..	98 —101	99 —101	..	..
50,000	Do. do. do. 4 % Deb. Stock	5	..	2½%	4 %	2¾ — 3¼	2¾ — 3¼	..	..
65,000	South London Electricity Supply, Ord.	Stock	..	..	..	83 — 87	83 — 87	..	..
100,000	South Metropolitan Electric Light and Power (Ord.	5	..	12%	8 %	4½ — 4¾	4½ — 4¾	4⅞	4⅞
50,000	(*Late Blackheath and Greenwich* 7 % Pref.	1	..	..	..	⅞ — 1	⅞ — 1	..	..
100,000	*Dist. E.L.Co.*) 4½% 1st Deb. Stock	1	..	..	..	1½ — 1¾	1⅝ — 1⅞	..	..
80,000	Urban Electric Supply, Ord.	100	..	..	..	106 —110	107 —110	..	..
80,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4½ — 5	4½ — 5	..	..
200,000	Do. do. 4½% 1st Mort. Deb. Stock Red ..	5	..	..	..	4½ — 5	4½ — 5⅛	5	4¾
110,000	Westminster Electric Supply, Ord.	100	..	..	..	101 —103	103 — 105	103⅜	..
28,141	Do. do. 5 % Cum. Pref.	5	10¾%	12 %	13¾%	12⅞ — 13¼	12⅞ — 13¼	13⅛	13⅜
		5	..	..	..	6¼ — 6⅝	6¼ — 6⅝	..	..

* Subject to Founders Shares. † Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS. Wednesday, November 9th.

CHEMICALS, &c.

		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	23/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 5	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a ,, (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£21	£1 inc.
a Lead, Nitrate	per ton	£25	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£37 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% a 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks ..	per lb.	3d.	..
a ,, Caustic (75/80%) ..	per ton	£24	..
a Shellac	per cwt.	240/-	10s. inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Crystals	per ton	£8	..
a ,, Bichromate, casks	per lb.	2¼d.	..

METALS, &c.

b Aluminium Ingots, in ton lots ..	per ton	£180	..
b ,, Wire, in ton lots ..	per ton	£168	..
b ,, Sheet, in ton lots ..	per ton	£166	..
b Babbitt's metal ingots	per ton	£48 to £140	..
c Brass (rolled metal 2" to 15", basis	per lb.	6¾d.	..
c ,, Tube (brazed) ..	per lb.	8¾d.	..
c ,, ,, (solid drawn)	per lb.	7¾d.	..
c ,, Wire, basis	per lb.	7¼d.	..
c Copper Tubes (brazed)	per lb.	9¼d.	..
c ,, ,, (solid drawn) ..	per lb.	9¾d.	..
c Copper Bars (best selected ..	per ton	£76	..

METALS, &c. (*continued*).

		Latest Price.	Week's Dec. or Inc.
g Copper Sheet	per ton	£76	..
g ,, Rod	per ton	£76	..
e ,, (Electrolytic) Bars ..	per ton	£66	..
e ,, Sheets ..	per ton	£82	..
e ,, ,, Rod ..	per ton	£76	..
e ,, ,, H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	per lb.	3/8	..
f ,, Sheet	per lb.	3/-	..
k German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	5/- to 5/1	Inc.
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	45/7½	1/- inc.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£13 5s. to £13 7 6	7/6 to 10/- inc.
g ,, Sheet	per ton	£11 17s. 6d.	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£7 15	..
d Mica (in original cases) small ..	per lb.	6d. to 1/	..
d ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p ,, rolled bars & rods	per lb.	1/- to 1/3	..
p ,, ,, strip & sheet	per lb.	From 1/1	..
o Platinum	per oz.	£4	..
e Silicium Bronze Wire	per lb.	9d. to 11d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i ,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£133 10 to £133 10	..
g ,, Foil	per lb.	1/6	..
n ,, Wire, Nos. 1 to 16	per lb.	1/8	..
p White Anti-friction Metals— "White Ant" brand ..	per ton	£42 to £62	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j ,, 6 lea. Flax	per lb.	5¾d.	..
j ,, 8 ply 10 lbs. Russian ..	per lb.	4¼d.	..
j ,, 10 lbs. Russian, single ..	per lb.	4¼d.	..
j ,, 180 lbs. Jute rove ..	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£27 7 6	10/- inc.

Quotations supplied by Messrs.:—a G. Boor & Co.; b The British Aluminium Co., Ltd.; c Thos. Bolton & Sons., Ltd.; d F. Wiggins & Sons.; e Frederic Smith & Co., f India-Rubber, G.P. and Teleg. Works Co., Ltd.; g James & Shakespeare; h Edward Till & Co.; i Boilling & Lowe; j Walter H. Hindley an Co., Ltd.; k Morris Ashby, Ltd.; m W. T. Glover & Co., Ltd.; n P. Ormiston & Sons; o Johnson, Matthey & Co., Ltd.; p The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Aberdeen	Nov. 5	1,166	+ 57	23	35,226	+ 5,667	10	—
Bath	,, 2	581	—	45	28,552	—	12½	—
Birmingham	,, 5	5,371	+303	45	242,357	+18,220	8½	—
Blackburn	Oct. 29	911	+123	31	30,173	+ 3,045	13½	—
Blackpool	Nov. 3	350	+ 19	31	41,129	+ 5,821	8½	—
,, —Fleetw'd	,, 5	934	+118	18	19,874	+ 409	7½	—
,, —Lytham	,, 3	58	—	—	58	—	7½	—
Bolton	,, 6	1,694	+ 7	32	59,944	+ 374	25	—
Bournemouth	,, 2	872	— 22	31	36,609	—	10½	—
Bradford	Oct. 29	4,518	+795	30	143,792	+27,271	53½	—
Brighton	Nov. 6	854	— 12	—	34,194	—	9	—
Bristol	,, 4	4,659	+188	—	—	—	28	—
Devonport ..	Oct. 28	521	+ 65	43	23,255	+ 3,378	5	—
Dudley—Sto'rb'ge	,, 28	811	— 10	43	37,944	+ 1,414	18½	—
Gateshead ..	,, 28	906	— 31	43	39,297	+ 1,400	10½	+ ½
Gr'n'k—Pt. Glsgw	,, 28	607	+ 58	43	25,163	+ 1,276	7½	—
Oldham—Ashton	,, 28	541	— 9	43	23,833	— 1,004	5	—
Potteries	,, 28	1,791	— 40	43	73,905	+ 5,429	28½	—
South Staffs. ..	,, 28	767	—254	43	33,284	— 6,147	21½	—½
Swansea	,, 28	518	+ 40	43	23,680	+ 1,018	5	—
Wolverhampton ..	,, 28	970	— 18	43	16,984	— 70	10½	+8
Yorks. Wool Dist.	,, 28	520	— 15	43	25,576	+ 8,815	6	—
Miscellaneous ..	,, 28	3,134	—	43	158,094	—	—	—
Burnley	Nov. 5	955	+177	—	—	—	10½	+½
Burton-on-Trent ..	,, 6	310	—	31½	11,418	—	6½	—
Cardiff	Oct. 22	1,964	+ 36	29	62,004	+ 1,768	14	—
Chatham & District	Nov. 3	624	— 21	44	26,201	+ 2,188	6½	—
Cork	,, 3	458	— 6	44	20,892	— 2,540	9·89	—
Dover	,, 5	186	+ 9	44	9,795	— 277	3	—
Dublin	Nov. 4	4,595	— 6	—	95,826	— 3,125	47	+ ½
East Ham	,, 5	636	—130	31	23,547	+ 1,480	6½	—
Glasgow	,, 5	14,529	+ 810	23	330,546	+18,501	72½	+ 6½
Halifax (2 weeks) ..	,, 2	2,628	+ 82	31	48,271	+ 3,598	34½	+ 2½
Huddersfield ..	,, 5	1,183	+ 46	31	43,853	+ 2,820	28	—
Hull	,, 5	2,172	+273	31	69,255	+ 9,153	13	+ 2
Ilkeston	,, 2	116	— 21	31	4,608	—	3·5	—
Ipswich	,, 5	370	—	31	16,365	—	10½	—
Isle of Thanet ..	,, 5	318	— 88	44	32,844	+ 1,609	10½	—
Leeds	,, 5	5,361	+527	31	189,274	+10,964	69½	+ 8½
Liverpool	Oct. 29	10,177	— 49	44	457,845	+12,998	105	—
London C. C. ..	Nov. 2	18,387	+3486	31	378,879	+80,028	47½	+ 7½
Manchester	,, 5	12,080	+856	31	388,404	+16,742	137½	+ 12½
Newcastle	,, 5	3,592	+ 43	—	—	—	17	—
Portsmouth	,, 5	1,543	+ 12	—	66,155	+ 5,373	14½	—
Salford	Oct. 31	4,044	+149	30	127,224	+ 7,860	30	—
Sheffield	Nov. 6	4,471	— 6	32	151,559	+ 2,919	34½	+ 1½
Southampton	,, 3	885	— 81	21	31,912	— 2,153	16½	—
Southend-on-Sea ..	,, 2	245	+ 8	31	12,624	+ 1,835	6½	—
Sunderland	,, 6	1,117	+ 23	31	41,266	+ 720	21	+ 1
Tyneside	,, 2	341	+ 29	44	17,390	+ 2,988	8·9	+ ·4
West Ham	,, 3	1,074	0—	36	33,771	—	9·78	—
Wolverhampton ..	,, 2	701	—252	—	—	—	9·5	—
Cen. London Rly. ..	,, 5	6,883	— 25	19	110,859	— 277	6	—
City & S. Lon. Rly.	,, 6	2,801	—136	19	46,971	—1,794	6½	—
Dublin—Lucan Rly.	,, 4	111	+ 17	18	2,465	—1,18	62	—
G. N. and City Ry.	,, 5	1,252	— 9	28	37,895	— 98	3½	—
L'pool Overh'd Rly.	,, 6	1,488	—117	19	30,573	— 1,385	8½	+4½
Mersey Railway ..	,, 5	1,548	+ 46	18	26,313	+ 2,115	4½	—

* Compared with the corresponding period of 1903.

REVIEWS.

Les Accumulateurs Electriques. By L. Jumau. Paris: Vve. C. Dunod, editeur. 1904. Price 29 fr.

In this work of 926 pages, Mons. L. Jumau has given us the most complete account of the accumulator which has yet appeared. He has brought together an enormous mass of information. The student, the manufacturer, and the engineer are all provided with data, not simply quoted from various sources, but ably discussed with a view to definite judgement. Moreover, the method of presentation is clear and generally convincing; the author is well read in his subject, and brings an unprejudiced mind to bear on the debatable points.

Mons. Jumau is also fortunate in his epoch. The general researches now in progress in different countries are carrying, or have already carried, most of those interested towards a definite conclusion. The more subtle and obscure points have been definitely ascertained, and the method of modern electro-chemistry is able to give a good account of nearly all the difficulties of a few years ago. Coming into this full heritage, M. Jumau provides a rich feast for his readers.

The following is the arrangement of the book. Part I. is on general theory, and has 14 chapters; of these, I. and II. deal with history and general electrolytic ideas; III. to VII., chemical theory, thermo-dynamics, theory of ions, E.M.F., and internal resistance; VIII., difference of potential during charge and discharge; IX., capacity; X., duration; XI., local action; XII., efficiency; XIII., formation; XIV., accumulators other than lead.

Part II. contains descriptions of accumulators, and has six chapters. These describe the manufacture of plates, paste, supports, filling, &c., and give particulars, and in many cases illustrations of the best known cells in Europe and America. There are many pages in this part which will interest the manufacturer.

Part III. has 11 chapters and deals with applications, such as stationary and portable batteries for tramways and central stations, and cells for automobiles and navigation, together with a very short statement respecting aerial flight. Other cells for lighting vehicles and for ignition purposes are described, with a final account of the applications of small accumulators.

The mere statement of these chapter headings suggests a great deal, but does not reveal the very detailed way in which most of the topics are discussed, and it will help the reader if we mention two points in which this work adds to the information obtainable in other text-books.

In the part dealing with the formation of the cell, M. Jumau gives more detailed and numerical quotation from the work of Gladstone and Tribe than is usual. For example, he quotes at length a table showing the gases absorbed and disengaged during the formation of a pasted plate. He also quotes the figures indicating the different efficiency of absorption as the current density is increased.

Again, arising from his own work, he gives some very useful curves which show at a glance the chemical changes which come over a pasted plate as it undergoes formation. All readers of this section must find their quantitative ideas made much more definite as they compare these data, and will easily make such modification in application as suits individual cases.

In the chapter on capacity, there is an excellent account of the work which has been done on the diffusion of acid into and out of the pores of the active material. The effect of temperature and of the chemical changes arising during charge and discharge is clearly established. He also describes the currents which arise from concentration changes in the pores of active material, and explains Dolezalek's conclusions very clearly.

This section also contains a short but sufficiently full account of the experiment in which Liebenow finally illustrated the important part played by diffusion in determining the capacity of a cell. An accumulator was made of two plates, the positive being placed in the middle of a lead box, while the negative was fixed and sealed in an opening cut in the side of the box. This box (with its centrally-placed positive) was then put into an outer vessel containing acid, and a discharge effected under ordinary conditions. After recharging, another discharge was taken, but the level of the acid inside the box was maintained at a higher level than that outside. The effect of this was to give a hydrostatic pressure continually urging acid through the pores of the negative from the inner to the outer part, and thus to reinforce the effect of ordinary liquid diffusion. It is evident that the arrangement tends to maintain the acid strength in the pores of the plate, and the interesting question to be solved was whether this would materially alter the capacity. Liebenow found, in this particular case, that the capacity was almost three times greater than in the first discharge, proving conclusively that it is the change in acid strength, which determines the exhaustion of a cell in an ordinary discharge. One may safely say that the rapid drop in pressure at the end of a discharge arises from want of acid, and practically from nothing else. Of course, peroxide of lead and spongy lead must also be there, but the foregoing experiment shows that the ordinary collapse is not due to absence of these substances, or any other change in the solid constituents of the plate, but to a deficient supply of acid. The condition of the active material and the degree to which it has been changed by the chemical actions of discharge are of no moment till the charge has proceeded much farther than is implied in any ordinary discharge. M. Jumau's volume is not quite so full as that of Dolezalek in respect of diffusion, but it supplies all the information which is likely to be needed.

The book has one or two faults. Considering its magnitude, more might have been said about the method of determining the efficiency of an accumulator. There is a careful statement of the main points, but an unwary reader would not learn the need for working under a cycle that can be repeated in subsequent experiments. A little more of the matter contained in the paper published by Prof. Ayrton, along with Messrs. Lamb and Smith, might have been included with advantage.

The chief lack, however, is an index. The table of contents does not make up for the absence of such an important help to the use of the book. If a good index had been provided, the volume might have been said to deserve almost unqualified praise.

The Electric Tramcar Handbook. By W. A. Agnew. London: H. Alabaster, Gatehouse & Co. 2s. 6d. net.

At last we are free of the reproach that our motormen and inspectors can be trained in their duties, or can study them only by the aid of alien text-books. Hitherto the only reliable publications have been two which hail from the States. One or other of these has found its home beside the family Bible of many an English motorman, actual or prospective, and to the present reviewer a most distasteful part of the instruction of motormen learners has been the recommendation of these books to the men. What else could one do? They are both well suited to their readers, more so to American than to English readers of course, and there was nothing else to recommend. Now, however, the want has been supplied, and supplied in a manner which will render it quite unnecessary in future to send money to publishers over the water, for "protection" has been obtained legitimately by producing something better than competitors can offer, and at a lower price.

Mr. Agnew is qualified in the highest degree to write a handbook on the work and duties of a motorman, and he has given us in the small compass of a hundred pages sufficient information to enable a man to drive an electric car over any British tramway, with an intelligent knowledge of the whole of the apparatus under his control.

We do not mean that any man could handle a car without some further preliminary training than the mere study of this or any other book, but, having been instructed in the actual operation of a modern electric car, the technical knowledge and practical hints transferred from between the covers of this handbook to his brain, will raise the student at once to the front rank of his fellows, and he will never be at a loss if he moves from one undertaking to another.

This little book, which, by the way, is carried easily in

the pocket, fills native requirements much more nearly than an American text-book written for American motormen can do, and this becomes more evident as year by year we build up for ourselves a kind of individuality in tramways.

Everyone knows how much beholden we were to America for methods and materials from the beginning of the tramway *renaissance*, and to what a degree we are enslaved even at the present day, but some spirits bolder than the mass have broken those chains that galled, and as the fashion sets or the difference in conditions is made more clear, so the British motorman will find more and more that guides to knowledge, efficiency, and promotion must be written by men trained in their own home school.

The American books have been most useful in their day, but we may rejoice patriotically now that their day is over.

The construction of Mr. Agnew's book is admirable, opening with ten pages of the clearest definitions, or, rather explanations, of electrical terms and apparatus with which the motorman may expect to meet; an equally brief chapter follows on the various electric traction systems in actual operation in England, particular allusion being made to the overhead system and its constituent parts. Then, as should be, the car and its many accessories are given well illustrated description, the path of the current through the car being detailed and explained, by means of a simple diagram.

The controller is the one thing above all others in the equipment which the motorman must understand, yet how many look upon it as a kind of complicated barrel-organ! They turn the handle fast or slow at their pleasure, and effects follow, but they have the dimmest notions of the really simple mechanism by which those effects are obtained. Not only the motormen, but their trainers also, are rarely as at home among controller diagrams as they might be if they themselves had been taught thoroughly in the first place, and no matter how clearly a chapter on controllers may be written, no matter how well diagrams may be printed, that chapter will set most motormen aback, unless they are helped through it by a sure hand.

The author of the book before us has realised fully the importance of the controller, and in a long chapter he has done his best to bring it within the comprehension of the simpler minded, but it will need, as every chapter yet written on controllers needs, a guide who will transform the network of lines in the diagrams from an incomprehensible and terrifying cobweb to its true significance. How impossible the puzzles of our youth appeared until they were solved! Therefore, let managers and engineers and motormen-trainers who introduce this book to their men see to it that it is not only read, but read with understanding. Chapter 5 contains short descriptions of the chief forms of brake found on cars. It is brought right up to date by the inclusion of the magnetic slipper and regenerative braking.

Chapter 6, "On the Road," deals in an incisive manner with every conceivable event in a motorman's working experience. The advice is always good, and any man who takes it every time need have no fear of an unpleasant visit to the office. That chapter and the next (which is also the last) should enable a motorman to deal promptly and certainly with any emergency or any defect. The probable reasons are given for all the faults and breakdowns which are almost sure to occur at one time or another in a motorman's career, and no aspirant to the front platform should be allowed to pass until he can reply to all the questions which arise out of those last two chapters.

The Electrical Review has insisted from time to time on the necessity for training motormen properly. Much still remains to be done in this respect, especially in the establishment of classes or schools, and this handbook will serve admirably as a text-book for the man who has to teach himself, and as a medium between the instructor and his students.

Electric Smelting and Refining. By Dr. W. Borchers. Translated from the third German edition, with additions, by Walter G. McMillan, F.I.C., F.C.S. Second English edition. London: Chas. Griffin & Co. 1904. Price 21s.

The first English edition of this work was published in 1897, and consisted of 405 pages with three plates and 188 illustrations; this edition has been enlarged to 548 pages with four plates and 225 diagrams and illustrations.

It seems a pity that the introduction to the old edition has been omitted from the new, as, although it contained data and explained elementary principles which are to be found in other text-books, it was so concise and clear that none but those versed in electro-metallurgical matters could well afford to dispense with it. Much valuable information has, however, been added elsewhere, and the work is brought up to date in the various branches of electro-metallurgical research.

Although approving of the additions, we can hardly refrain from expressing the opinion that there was no necessity for enlargement, for many old and obsolete processes are described at length that might with advantage have been omitted, sufficient, in fact, to compensate for the new matter added. Many of these old processes have failed and have been the cause of much financial loss, so that it cannot be a source of much pleasure to their inventors to see them again unearthed.

To the chapter on sodium has been added a description of the later methods of electrolysing fused chlorides, nitrates and hydroxides, and various diagrams of modern crucibles for the production of lead-sodium alloys.

The recent extensions of calcium reduction on a commercial scale are ably dealt with in Chapter V., and a note is added on the preliminary treatment of bauxite for the production of aluminium.

The chapter on the reduction of the "Cerite" metals, dealing with cerium, lanthanum, and neodidymium has now been enlarged to 16 pages, and is very complete.

The research work which has been carried out in almost every branch of electro-metallurgical science is so vast, that it is quite impossible to mention the outline of even the most important, but in this work no pains have been spared to describe the advance in detail, although there appears a slight tendency to overlook what has been done in this country.

The actual practice of copper refining has remained more or less stationary, but some investigations have been chronicled with regard to the recovery of the metal from the crude ore. Nickel and zinc, on the other hand, are receiving a stimulus from an electro-chemical standpoint, especially the recovery from their native minerals.

The last three chapters deal with the electric furnace, and describe the reduction of chromium, molybdenum, tungsten, uranium, manganese and iron. The latter has made considerable progress, and the more recent furnaces for smelting it are fully detailed. The remaining chapter on carbides and silicides has been entirely re-written to meet the necessities of the case.

Altogether the new edition does credit to the authors, and undoubtedly remains the standard work on electro-metallurgy.

THE FIFTH INTERNATIONAL ELECTRICAL CONGRESS.

By R. BORLASE MATTHEWS, WH. EX.

(*Concluded from page* 765.)

On September 17th a final general meeting of the Congress was held, Prof. Elihu Thomson taking the chair, and in a brief speech expressing the general satisfaction of all in attendance on the Congress at its great success. He then called upon Prof. Henri Poincaré, representative of France to the Chamber of Delegates. With regard to the work of the Chamber of Delegates, the meetings of which he had unfortunately arrived too late to attend, Prof. Poincaré said that he agreed fully with the recommendation that they had made, namely, that future action concerning the creation of, or changes in, units and standards, should be left to an international commission appointed by the various governments of the world, which would not sit amid the distractions of a World's Fair.

Mr. R. K. Gray responded on behalf of Great Britain, and Prof. L. Lombardi for Italy, both of whom agreed with the conservative action of the Chamber of Delegates.

Prof. Arrhenius responded for the other foreign countries, and Prof. A. G. Webster, President of the American Physical Society, on behalf of the co-operating societies. The fifth International Congress was then declared adjourned.

Thus closed what was, undoubtedly, the most successful of the five congresses thus far convened. The only complaint that could be urged against it, perhaps, was that, if anything, too much was attempted, for, with about 160 papers to read, even when divided up into eight sections working simultaneously, the discussions had to be very brief, and a number of the papers presented in abstract. The subdivision also took away some of the enthusiasm that would have been raised in larger meetings, and, in addition, often prevented members from attending the reading of all the papers in which they took an interest. Invitations have been issued for written communications to be added to the discussions before they are printed in the *Transactions*, which will in some measure, it is hoped, make up for the lack of discussion by leading men on certain subjects, owing to their presence in other sections at the time the papers were read.

Those papers which were written in languages other than English will be translated into the latter tongue.

Full reports were taken down at each meeting by stenographers, as is usual at the meetings of the individual societies, so a very valuable set of transactions will probably be the outcome of this Congress—records of the experience of a wider sphere than can be the case with an individual society holding its meetings in a restricted area.

A very pleasing function of a semi-private nature, in connection with the visit of the British Institution of Electrical Engineers to America as guests of the American Institute, terminated the social events of the week. After the final meeting of the Congress, Mr. R. Kaye Gray, President of the British Institution of Electrical Engineers, entertained a number of the members of the American Institute, and also some of his own party, to lunch in the Exposition grounds, and after the lunch made a personal gift of a splendid painting, picturing Dr. Gilbert, of Colchester, performing some of his historic experiments before Queen Elizabeth, to Mr. Bion J. Arnold, as representing, in his capacity as president, the American Institute of Electrical Engineers. Mr. Arnold responded on behalf of his Institute, thanking Mr. Gray very warmly for his magnificent gift, which, he assured him, would have a prominent place in the new building that was being erected for the various engineering societies of America in New York.

The Chamber of Delegates, International Electrical Congress, St. Louis, 1904.

Twelve nations were represented by one or more official delegates in the Chamber of Delegates at the above-mentioned convention. The names of the countries and their delegates were given on page 605. Great Britain and France only at the last moment gave official recognition to the Chamber, and Germany only a partial recognition, not allowing her one delegate to vote on questions of units and standards.

The various proposals that had been suggested officially or unofficially to the members of the Chamber were first of all generally discussed, and eventually two sub-committees were formed to make a report on the two most important matters, namely, the International Electro-magnetic Units, and the International Standardisation of Electrical Apparatus and Machinery.

The report on the first-named subject was as follows :—

"It appears from the papers laid before the International Electrical Congress, and from the discussions, that there are considerable discrepancies between the laws relating to electric units, or their interpretations, in the various countries represented, which, in the opinion of the Chamber, require consideration with a view to securing practical uniformity.

"Other questions bearing on nomenclature and the determination of units and standards have also been raised, on which, in the opinion of the Chamber, it is desirable to have International agreement.

"The Chamber of Delegates considers that these and similar questions could best be dealt with by an International Commission representing the governments concerned. Such a Commission might, in the first instance, be appointed by those countries in which legislation on electric units has been adopted, and consist of (say) two members from each country.

"Provision should be made for securing the adhesion of other countries prepared to adopt the conclusions of the Commission.

"The Chamber of Delegates approves such a plan, and requests its members to bring this report before their respective governments.

"It is hoped that if the recommendation of the Chamber of Delegates be adopted by the Governments represented, the Commission may eventually become a permanent one.

"That the Delegates report the resolution of the Chamber as to electrical units to their respective governments, and that they be invited to communicate with Dr. S. W. Stratton, Bureau of Standards, Washington, U.S.A., and Dr. R. T. Glazebrook, National Physical Laboratory, Bushy House, Richmond, Surrey, England, as to the results of their report, or as to other questions arising out of the resolution."

The report on the second subject was as below :—

"That steps should be taken to secure the co-operation of the technical societies of the world by the appointment of a representative commission, to consider the question of the standardisation of the nomenclature and ratings of electrical apparatus and machinery.

"If the above recommendation meets the approval of the Chamber of Delegates, it is suggested by your Committee that much of the work could be conducted by correspondence in the first instance, and by the appointment of a general secretary to preserve the records and crystallise the points of disagreement, if any, which may arise between the methods in vogue in the different countries interested.

"It is hoped that if the recommendation of the Chamber of Delegates be adopted, the Commission may eventually become a permanent one.

"That the delegates report the resolution of the Chamber as to International Standardisation to their respective technical societies, with the request that the societies take such action as may seem best to give effect to the resolution, and that the delegates be requested to communicate the result of such action to Colonel R. E. B. Crompton, Thriplands, Kensington Court, London, England, and to the President of the American Institute of Electrical Engineers, 95, Liberty Street, New York, U.S.A."

These reports were unanimously accepted at a general meeting of the Chamber of Delegates, as an expression of their views.

In speaking at the closing meeting of the International Electrical Congress, Prof. Poincaré, Mr. R. Kaye Gray and Prof. L. Lombardi all upheld the action of the Chamber of Delegates. Such also seemed to be the universal opinion.

It will be noted that in the case of the report on the Electro-Magnetic Units, a Commission to be named by the various governments was proposed, which was wise, since the units will eventually have to be legalised by these governments. On the other hand, in the report on the standardisation of electrical apparatus and machinery, the Commission is to be chosen by the national electrical associations of the world—that is, the people most concerned in this particular standardisation.

Though the deliberations of the Chamber of Delegates of the 1904 Congress have not resulted in any radical decisions as to units or standards, as was the case in 1881, 1893, or 1900, undoubtedly their recommendations will put matters on a much firmer basis for future decisions, than would otherwise have been the case.

THE FARADAY SOCIETY.

There can be few scientific bodies more catholic in their sympathies than the Faraday Society, which, with all the eager enthusiasm of youth, held the first meeting of its session at a period when its older and graver sister-societies were barely beginning even to think about the unpleasant necessity of awakening from their long summer slumbers. For the subjects discussed on Tuesday week represented each one of the three great sections into which it is possible

to sub-divide science. There was, first, the severely theoretical, in Dr. Henry Sand's ingenious paper on "The Measurement of the Potential of the Electrodes in Stationary Liquids"; then followed the industrial, or at least potentially industrial, namely, Miss Buena Pool's "Note on a Suggested New Source of Aluminium"; and, finally, there was the technological, represented by a paper entitled "Electrolytic Oxidation of Hydrocarbons of the Benzene Series," by Mr. H. D. Law and Dr. F. Mollwo Perkin. Truly the members cannot complain of want of variety in the fare set before them by the Council!

The exact bearing of Dr. Sand's work will best be appreciated by a brief reference to some experiments which he described before the Physical Society in 1900 (*Phil. Mag.*, Jan. 1901), where he showed that in the electrolysis of a mixture of copper sulphate and sulphuric acid, provided there is absolutely no convection in the solution, no hydrogen at all appears at the cathode until the concentration of copper round it has fallen to zero. On the other hand, convection currents play such an important part in the process, that in cases where otherwise as much as 60 per cent. hydrogen would be deposited, stirring causes none whatever to be formed. Obviously, the great difficulty in investigations such as these is to ensure that the liquid near the cathode really is *stationary*, so that, as the author pointed out in the discussion, his experiments were really *diffusion* experiments, and they amounted in fact to the designing of an apparatus in which convection currents tending to upset the cathode-concentration of electrolyte should be as far as possible eliminated. In the carefully thought out apparatus as finally designed, the electrode whose potential it was desired to measure could be placed in a perfectly horizontal position either at the top or at the bottom of the apparatus, according as the electrolyte became lighter or heavier during electrolysis. A liquid connection to a standard electrode was tapped off some few millimetres in front of the electrode, so that the E.M.F. actually measured on the potentiometer between the cathode and the standard electrode was made up of (1) the P.D. due to polarisation between the cathode and adjacent liquid; (2) the drop of potential along the electrolyte, which was both calculated and measured; and (3) the known E.M.F. of the standard electrode. In this way Dr. Sand was able to measure the electrode-potential required, and the results when compared with known data showed that the apparatus and the method could be relied upon to give really accurate measurements of electrode-potentials, without any doubt as to what was the value of the concentration of the electrolyte under examination. The potentials actually measured were with aqueous solutions of copper sulphate, silver nitrate, and zinc sulphate, acid and alkaline solutions of nitrobenzene, and alcoholic solutions of cuprous chloride. The results obtained were of considerable interest, but they cannot be adequately described without reference to the curves given in the paper. There is, however, an interesting point in connection with the electrolysis of cuprous chloride that might be noted. The solution employed had become partially oxidised to the cupric state, and the potential-time curves showed two distinct breaks, the first corresponding to the reduction of cupric chloride, and the second to the deposition of copper.

The suggested new source of aluminium referred to in Miss Pool's paper is India, where it appears there are thousands of square miles of surface covered with so-called laterite deposits varying from a few feet to hundreds of feet in thickness. These laterites, and in particular the high-level laterites, are closely analogous to bauxite, and their pureness, ready accessibility, widespread occurrence and association with flowing water (perhaps the most important condition of all) point them out, in the opinion of the authoress, as an almost perfect source of aluminium. There is, however, little likelihood of Indian laterites displacing French bauxite as far as the English market is concerned, because, as Mr. W. Murray Morrison pointed out, the latter are for present needs practically inexhaustible, and the laterites, just like bauxite, could not be used in the raw state—they contain too much silica and other impurities for that—but would first have to be treated for alumina. There is no reason to doubt that in time, if a considerable demand for aluminium should ever arise in India, these deposits could be profitably worked *in situ*.

The paper by Mr. Law and Dr. Perkin is really of more interest to the organic chemist than to the electrical engineer or physicist. Their work represents the first instalment of a detailed and systematic study of the electrolytic oxidation of hydro-carbons of the aromatic series, and when complete should prove of great value. The substances they oxidised were toluene, ortho-, meta- and paraxylene, mesitylene and pseudo-cumene, in each case forming principally the corresponding mono-aldehyde. In no case was the corresponding acid produced. The method employed in all cases was to form an emulsion of the hydro-carbon with acetone and then electrolyse in dilute sulphuric acid in the anode compartment of a cell. The chief experimental difficulty was found to be the formation of tarry products owing to the continually increasing concentration of sulphuric acid in the anode chamber. Unfortunately no suggested remedy for overcoming this difficulty was forthcoming at the meeting, in spite of the many learned chemists that formed a goodly proportion of Dr. Perkin's audience. The indefatigable authors are now engaged in the investigation of hydro-carbons of the benzene series containing other than the methyl group, and of hydrocarbons containing methyl and other groups in the same nucleus, in order to see which group or groups are the more readily attacked, and they hope before long to be able to lay the results of their further labours before the Faraday Society.

VISIT OF THE INSTITUTION OF ELECTRICAL ENGINEERS TO AMERICA.

[BY OUR SPECIAL COMMISSIONER.]

(*Continued from page* 567.)

After the termination of the meetings of the Electrical Congress at St. Louis, the Institution party, once more exchanging the hotel for the train, left St. Louis on September 17th for Pittsburg, where they stayed at the Shenley Hotel.

On Monday, the 19th, the Pittsburg local Reception Committee had made arrangements for visits to the following works in the district:—The Westinghouse Electric and Manufacturing Co., the Westinghouse Machine Co., the Westinghouse Air Brake Co., the Union Switch and Signal Co., the R. D. Nuttall Co., the Nernst Lamp Co., the Carnegie Steel Works, Bessemer, and the Carnegie Steel Works, Homestead. Of these factories, all except the last two are Westinghouse concerns. Six series of visits were arranged, each comprising a different series of works, some allowing the visitors to spend most of their time in a few of the works, or alternatively a more rapid tour through a greater number.

Amongst the many items of special interest were the mechanical foundry arrangements at the Westinghouse Brake Co.'s Wilderming factory. A continuous travelling table brought the flasks to the moulders, who, by the aid of pneumatic machines, rapidly completed a mould, the sand being supplied from a hopper above; the completed mould was then returned to the travelling table and carried to the cupola, where the metal was run in from ladles, the workmen standing on and travelling with the tables while pouring; cooling while travelling down the foundry, the castings were in a fit state to be removed from the flasks. Two men lifted the latter off the table, allowing the casting and sand to fall on to a grating, the sand passing through while the casting remained on top. The sand was caught in a conveyor, mixed and damped, and then returned by overhead conveyors to the moulders. The whole cost of making the castings is reduced to a minimum by the adoption of these mechanical methods. The attraction at the Union Switch Co.'s works was the model track with life-size signals. In the very long bays of the Electric and Manufacturing Co., several large alternators were in course of construction, surveyors' instruments being used to accurately lay off the ends of the segments, so that when put together they would fit accurately.

A car truck, equipped with the Westinghouse single-

phase series motors and controlling apparatus, was erected on a substantial frame, with ample room for passing underneath, so that the operation of the apparatus might easily be inspected. Two turret type multiple unit controllers were undergoing a very searching life test, one being fitted up with various types of fingers to investigate the best design, and the other connected up to a pair of motors driving heavy fly-wheels. In both cases automatic electrical devices were employed to cause the operation of the controllers to be repeated continuously.

In the Machine Co.'s shops, the Westinghouse-Parsons steam turbines were the special feature. A water brake of ingenious and simple construction was noted, with which, accurate brake-horse-power tests could be made more quickly than by coupling up a dynamo and making the necessary tests to allow for the losses in the dynamo itself.

Each group was entertained to lunch by one of the works they visited, and at six o'clock all met together again in the end of one of the new one-third mile long aisles of the Westinghouse Electric and Manufacturing Co.'s Works, which had been decorated and arranged as a reception room and banqueting hall. The tables were arranged in the form of a double figure eight, with three round tables in each centre. Bremer arcs and Cooper-Hewitt lamps were used to light the hall, the latter being provided to allow of a photograph being taken.

As time was limited the speeches were very brief. Mr. Westinghouse, who received a tremendous ovation, welcomed the visitors in a few well-chosen words, responses being made by Mr. Gray, Prof. Ascoli, and Mr. B. J. Arnold.

Unfortunately, though the new aisle might be eminently suited for the purpose for which it was constructed, its acoustic properties were very poor, so it was difficult to hear the speeches. Mr. Arnold eulogised Mr. Westinghouse, as one of the fathers of the industry which they represented, and which to-day was of supreme importance to the human race. He also briefly referred to the work that had been carried out by the Westinghouse staff. Mr. Westinghouse had that invaluable quality in that he knew how to choose and encourage his staff, and was ever ready to hold out a helping hand to a young man who was anxious to rise, thus assisting him to reach a position of trust.

After the dinner, the special Pullman train drew up at the works, and, subsequently travelling all night, conveyed the party to Washington, which was reached at 7.30 a.m. on September 20th. Breakfast having been provided at the New Willard Hotel, special cars were taken to the National Bureau of Standards, situated about 3½ miles from the Treasury, on a site that is free from the vibration of street traffic. This institution comprises two buildings, the larger of which is intended for a physical laboratory when completed, and the smaller, a part of which is already in use, for a mechanical laboratory; the latter building contains the mechanical plant, instrument shop and laboratories for the heavier kinds of experimental work where considerable power or heavy electric currents are required.

A constant temperature being of very great value in a laboratory, special attention has been paid to this feature. In each room was fixed a thermostat of very simple and compact construction, connected by insulated wiring to the electrically-controlled heating, cooling and ventilating apparatus in the basement; thus any room could be kept at a constant predetermined temperature. The electrical generating apparatus is so planned that a very wide range of experiments can be carried out with either direct or alternating current, direct current being available at potentials up to 10,000 volts and up to 10,000 amperes, and still higher alternating current voltages being obtainable. A number of alternating current dynamos are directly coupled to motors which can furnish single-phase and polyphase current; some of these machines have smooth core armatures and specially shaped pole-pieces so that sine waves could be obtained, others give distorted waves, and another which is being constructed is designed to give several harmonic components, which may be combined to give different wave forms. In the heavy current laboratory, four large storage cells are provided, capable of giving a current of 10,000 amperes at the one-hour rate of discharge. The supply of gas, compressed air, vacuum, hot and cold water, ice water and distilled water is provided for; for high temperature, gas and electric furnaces are utilised, and for low temperatures, cold brine, carbon dioxide and liquid air are available.

In the instrument shop—an important adjunct to a physical laboratory—a number of machine tools are fitted and work was in full swing. In the mechanical test room a Riehle multiple lever tension and compression testing machine of 100,000 lbs. capacity was noted. Rooms are provided for photometrically testing and calibrating various kinds of lamps, the Lummer-Brodhun and Simmance-Abody flicker photometers being used. An incandescent lamp is used as a secondary standard, and its distance from the photometer is always kept constant, thus only the distances between the standard lamp and the photometer need be measured for comparative purposes.

Some good work has already been done by the Bureau in its temporary quarters, which serves as an indication of what may result when the new laboratories get into full working order.

The party then returned in the special cars to the Capitol, where the Senate room and Court of Supreme Jurisdiction and other features of interest were seen. Crossing the road they reached the Library of Congress, an exceedingly well-arranged fireproof building. An ingenious system of book lifts and carriers are adopted here to convey the books required by the readers from the book stores, which extend some distance away from the reading room, to the distributing desk, the arrangement being such that all danger of damage to the books is avoided.

Lunch was partaken of in this building, and the party then divided into groups under the guidance of the local Reception Committee, some going to see the chief buildings and institutions in the City, others to the Government printing office and navy yard, or to the telephone exchanges and power installations.

(To be continued.)

SIMPLE STORIES.

By "INNOCENS."

XII.—Alice in Blunderland.

The Mad Hatter was in a dreadful hurry. He tumbled and slipped, and wiped his hat with his handkerchief the wrong way of the silk to keep it from perspiring. "Oh my goodness!" he said to Alice, "*Do* come along. If you don't hurry up we shan't get the trams on in time, and then the British Dormouse will oversleep itself."

Now Alice was a very human little girl, and like most girls when they are told to do anything, she stood still and argued about it. "What am I to hurry for? According to your own statement, you've been rushing like this for the last two years and you haven't got the trams right yet. Why can't you let things rest a bit, and own up that you have a very bad tram system?"

"But—oh my hat!—what would the Duchess say!" sobbed the Hatter. "Come along, do, and we'll start the early workman's car."

When Alice saw the tram she could scarcely believe her eyes. "Why, where's the trolley pole and the wire?" she exclaimed. "And what's that great gap in the road?"

"We don't do things like other people here," exclaimed the Hatter, proudly. "You put your wire up top, so we put ours down under. That slot's to improve the artistic appearance of the road. Divides it into two and makes a symmetrical picture. You should hear the cabbies swear when their wheels catch in it. Artistic, very."

"But I don't see the good of it!" objected Alice.

"I don't suppose you do!" exclaimed the Mad Hatter, pettishly. "Little girls never do. Why, it's four times as expensive to keep up as your system. Money, instead of being locked up in the pockets of the few, circulates among the many. The country is made richer, gladder, happier through our system."

"Yes, but how does it pay?" asked Alice.

"Oh, shut up, do!" snapped the Hatter.

Alice thought this very rude, so she was rather cold and distant for a time. Presently, however, the lights in the car

got dimmer and dimmer, till all at once the circuit-breaker came out with a crash.

"Goodness!" said Alice. "What's that?"

"Nothing—nothing," the Hatter reassured her. "You see, we're feeding along a temporary cable from Bankside—no, Deptford—no, Loughborough Junction—I don't know where we're feeding from at present. Anyway, the volts get so low that the motor current is excessive, and the circuit-breakers come out. Wretched things, these temporary cables. All right some day."

"Yes; but why do you use temporary cables? Haven't you got your system down yet?"

"Well, you see"—here the Mad Hatter became condescending—"we have introduced an entirely new method of construction on our lines. *You* would naturally have built your station first, and then supplied from it, wouldn't you?"

"Certainly," said Alice.

"Ah!" said the Hatter, in a satisfied tone. "We do things better. We put our system down first, and build the station after we've got the trams running. We therefore save station costs for at least two years."

"But you must get your current from somewhere!" objected Alice.

"Oh, yes," said the Hatter, "we buy it at tuppence a unit from everybody else. Much simpler than making it ourselves."

"Tuppence a unit is a very high price," said Alice, thoughtfully. "We sell ours for a penny-farthing. And what will you do with all your temporary cable when you've got your own station?"

"Oh, don't worry about that," said the Mad Hatter, light-heartedly; "we may never get the station."

ENAMELLED WIRE FOR HEATERS AND RESISTANCES.

By E. KILBURN SCOTT, M.I.E.E., A.M.I.C.E.

Electric heaters for tramcars and switch resistances embedded in enamel have been used for some years, but the high price of energy and some small technical difficulties of construction have hitherto prevented electric cooking apparatus from becoming a staple article. The success, however, which has now been attained with such apparatus, combined with reduced prices for energy, will eventually bring it into general use. As it appeals principally to the feminine, when it does come into fashion it will come with a bound, as was the case with gas stoves, and more recently bicycles.

The development of a suitable resistance wire and insulating enamel is the key to the situation. Such a wire has been found in a copper nickel alloy in the ratio of about 6 to 4. Whilst the most successful method of enamelling is to put it on in the form of a powder and heat the wire electrically until the enamel runs and covers the surface. More powder is then added and so on until it is of the required thickness. Enamelling has been brought to such a pitch of perfection, that temperatures as high as 300° to 400° C. can be carried without imperilling the life of the apparatus or causing the enamel to crack off.

Amongst the various firms engaged in the business is the Simplex Electric Heating Co., of Cambridge, Massachusetts (a firm formed by the amalgamation of 14 different companies). Amongst their specialities are soldering irons, glue pots, ironing machines, and a biscuit baking machine, which will bake continuously in a more cleanly, certain and cheaper manner than ovens heated with coal fires.

The Ward-Leonard Co. were early in the field in the use of enamel resistance wire and their starting and regulating enamel resistances are in use all over the world. Besides the economy of space there is less chance of connections becoming crystalline and broken, as the enamel holds everything so firmly in position.

Mr. Leonard recently told the writer a very significant fact which shows how things are moving, it was that all the small coils for telegraph instruments in the States are now being wound with enamelled wire, the usual cotton covering having proved unsatisfactory. This is as it should be, and the writer looks forward to the time when cotton and tape and such like unmechanical materials are also banished from motor and dynamo work.

DUAL COMMISSIONS.

[By our Legal Contributor.]

A leading article which appeared in the Electrical Review for October 28th dealt with the ethical aspect of the rule made by the Council of the Institution of Electrical Engineers against the receipt of secret commissions. The Council declared that "No consulting engineer should receive trade or other discount, or surreptitious commissions or allowances in connection with any work which he superintends."

Owing to the fact that secret commissions are prevalent, and that the giving of them is not often brought to light, there is a tendency in some quarters to consider that the persons who are parties to giving or receiving them are not within the reach of the law. This is an entirely erroneous view; and it represents an opinion which has been strengthened in the minds of some people by the fact that the Government has from time to time introduced measures having for their object the suppression of secret commissions. Unfortunately, however, they have not become law.

The last of these measures was drafted so as to provide that—

(1) If any agent corruptly accepts or obtains or agrees to accept or attempts to obtain for any person, for himself, or for any other person, any gift or consideration as an inducement or reward for doing or forbearing to do, or for having after the passing of this Act, done or forborne to do any act in relation to his principal's affairs or business, or for showing or forbearing to show favour or disfavour to any person in relation to his principal's affairs or business; or (2) if any person corruptly gives or agrees to give or offers any gift or consideration to any agent as an inducement or reward for doing or forbearing to do, or for having after the passing of this Act done or forborne to do any act in relation to his principal's affairs or business, or for showing or forbearing to show favour or disfavour to any person in relation to his principal's affairs or business; or (3) if any person knowingly gives to any agent, or if any agent knowingly uses with intent to deceive his principal any receipt, account, or other document in respect of which the principal is interested, and which contains any statement which is false or erroneous or defective in any material particular, and which to his knowledge is intended to mislead the principal, he shall be guilty of a misdemeanour, and shall be liable on conviction or indictment to imprisonment, with or without hard labour, for a term not exceeding two years, or to a fine not exceeding £500, or to both such imprisonment and such fine, or on summary conviction, to imprisonment with or without hard labour, for a term not exceeding four months, or to a fine not exceeding £50, or to both such imprisonment and such fine.

"Consideration" includes valuable consideration of any kind. A prosecution under the Act is not to be commenced without the sanction of the Attorney-General or Solicitor-General.

It is to be noticed that this measure was intended to affect both the giver and the recipient of the commission. The giver deserves censure because—to take the case of the contractor—the contract price must inevitably be increased by the amount of the commission. The recipient, of course, deserves to be hit, because however firmly he may refuse to allow his duty to his principal to be warped or influenced by the commission, the mere payment is sufficient to show that he is not acting solely in the interest of the firm or person who employs him.

Commercial men have long wished that a Bill drafted on the above lines might become law, but up to the present they have wished in vain. It is conceived that the Legislature do not feel justified in passing a measure which would necessarily have the effect of implicating a large number of persons.

It must not be assumed that commission received by an agent or the trustee of a purchaser from a vendor, without the knowledge of his principal, is a bribe; it is a profit which the principal has a right to extract from the agent whenever it comes to his knowledge (Phosphate Sewage and Co., *v.* Hartmont, 5 Ch. D., 394). Moreover, under existing

law, an agent for sale, who takes an interest in a purchase negotiated by himself, is bound to disclose to his principal the exact nature of his interest; and it is not enough that he should merely disclose that he has an interest, nor is it enough for him to make statements such as would put the principal on inquiry (Dinn *v.* English, L.R., 18 Eq. 524). Lord Justice Romer in the case of Hovenden *v.* Milhoff (1900, 83 L.T. 41) said :—"If a gift be made to a confidential agent with the view of inducing the agent to act in favour of the donor in relation to transactions as between the donor and the agent's principal, and that gift is secret as between the donor and the agent—that is to say, without the knowledge and consent of the principal—the gift is a bribe in the view of the law." The Court will not inquire into the motive of the vendor in giving the bribe. There is an inevitable presumption that the agent was influenced by the bribe.

It is to be observed, however, that it must be shown that the receipt of a commission makes, or is likely to make, the agent have an interest contrary to that of his employer. In Rowland *v.* Chapman—a case heard in 1901—one of the purchasers of land who acted as agent for all the purchasers in negotiating the purchase received a commission on the amount of the purchase money from the vendor, but his interest was to obtain the land as cheaply as possible. It was decided that the purchasers were not entitled to rescind, and that the rule that a purchaser can rescind a contract for sale, entered into by his agent on his behalf, on the ground that the agent has received a secret commission from the vendor, only applies where the agent has, by reason of the receipt of the commission, an interest conflicting with his duty to his principal.

Such is the law, and it must be conceded on all hands that the law is just, and consonant with what is but the highest commercial morality. We think we may safely say that, so far as the electrical world is concerned, the law with regard to secret commissions has no need to be strengthened.

NEW OZONISER.

Few people but those directly interested, probably, fully realise the increasing importance and number of the applications of ozone, and the amount of attention which has been devoted to the improvement of ozonising apparatus during recent years. We have from time to time published articles on the subject, the last of which appeared on August 19th last, and we now have pleasure in giving a description of a new and greatly improved apparatus, the principle of which is due to Mr. A. Rosenberg, and which has been brought to our notice by Mr. Edward L. Joseph, lately the manager of the Consolidated Electrical Co., Ltd., who is the owner of the patent. A small-sized apparatus has been at work from time to time in our office during the past fortnight, and, so far as can be judged by a merely qualitative test, produces ozone freely and without the accompaniment of unpleasant nitrous oxides, &c.

As a matter of fact, the last-mentioned qualification is one of the chief advantages claimed for the new apparatus; other important features are the very large output of ozone for a given expenditure of energy, and the great reduction in the cost of the ozoniser.

The accompanying illustrations are reproduced from a photograph of the ozoniser and a drawing showing its internal arrangements. In the main, the apparatus consists of a mahogany box measuring about 16 in. × 16 in. × 28 in., lined with asbestos board, and containing a small electric fan F to produce the necessary circulation of air, a number of baffle plates A A on which the actual ozonising grids are fixed, and a small step-up transformer T. The front of the box is made removable, and carries the switch gear, which simultaneously controls the fan and the ozoniser, and makes connection with the internal parts by means of the spring contacts S C, shown in the drawing; thus there are no loose connections to be handled. The remaining apparatus consists solely of a small direct-current motor fitted with slip rings from which an alternating current can be collected, to feed the transformer, and this can, of course, be dispensed with when an A.C. supply is available.

The ozoniser proper is of the type in which the discharge takes place in the substance of the air under treatment, as distinguished from those in which the air is completely separated from one or both of the electrodes by means of glass or other dielectric. Each element of the ozoniser consists of a thin sheet of highly insulating material, such as micanite, against which are applied, on either side, sheets of copper gauze having 40 meshes to the inch. These sheets are connected alternately to the two poles of the step-up transformer, which gives a potential difference of 4,500 volts—this having been found by experiment to be the best pressure for the purpose.

It will be seen that the current of air drawn through the ozoniser by the fan is constrained by the arrangement of the elements, acting as baffle-plates, to pass over the whole of the ozonising surfaces, which have an area of nearly 4 sq. ft. in the apparatus in question. As at each corner of each mesh of the gauze the wire is necessarily bent, so as to form an elevation, which may be regarded as a rounded point, there are 230,400 such points to every square foot of the ozonising surface, or a total of over 900,000. From each of these a discharge takes place upon the surface of the dielectric; but, owing

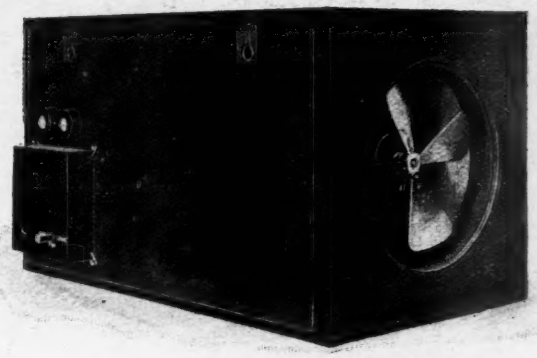


Fig 1.—The Ozoniser, Complete.

to the extreme sub-division of the discharge, there is no sparking whatever, and hence no nitrous compounds are formed—a very important advantage. The air inlet is guarded by a stout netting of brass wire G, and all the high-pressure apparatus is enclosed within the case; as the connections are necessarily severed in the act of opening the case, it is impossible to obtain a shock from the apparatus. The current supply is obtained by means of flexible connections and plugs from ordinary lamp-holders, but of course more substantial connections can be made where the apparatus is permanently fitted up. Lastly, we may add that the whole of the ozoniser, which was made from Mr. Joseph's designs, and embodied many of his improvements, is well finished, and forms quite a handsome *ensemble*. Owing to the simplicity of the apparatus, it can be made in many other forms, to suit the requirements of special cases Thus, in the case of a building having a ventilating shaft to supply fresh air, it is not necessary to have the fan or the wooden case; a set of the ozonising plates can be fixed at a convenient position in the shaft, together with the step-up transformer.

We understand from Mr. Joseph that some remarkably successful experiments have just been made by means of this ozoniser in connection with the perfect combustion of fuel in furnaces. This may open up a new field for the use of ozone.

As for the output of the apparatus, we are informed that it is capable of ozonising 30,000 cb. ft. of air per hour, with the expenditure of 60 watts, including the losses in the rotary converter, which do not enter when an A.C. supply is available. At a price of 2d. per unit, therefore, the cost of 30,000 cb. ft. of ozonised air, suitable for the aeration of a living-room or workshop, would be no

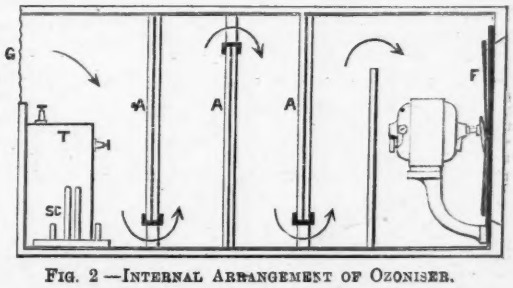


Fig. 2.—Internal Arrangement of Ozoniser.

more than ½d. These results, we believe, are quite unprecedented. The actual production of ozone is said to amount to no less than 250 grams for an expenditure of 1 unit. When we remember that the capital cost of the Yarnold apparatus, described in our issue of November 5th, 1897, was £1,300 for an output of 10,000 cb. ft. of ozonised air per hour, and that the working cost was ½d. per 1,000 cb. ft., while the present apparatus costs one-thirtieth and produces ozonised air at $\frac{1}{150}$th as much, we see that a very great advance has been made

For the manifold uses of ozone, we may refer our readers to Mr. J. B. C. Kershaw's article in our issue of August 19th, 1904, which will shortly be followed by the concluding portion, and to the Electrical Review of July 29th, 1898; November 7th, 1902; January 2nd, February 27th, and December 25th, 1903.

Engineering Standards Committee.—As briefly noted in our issue of October 28th, we have received from the secretary of the Committee a copy of the British Standard Specification and Sections of Bull-Headed Railway Rails, in which the chemical composition, mode of obtaining samples, mode of manufacture, and dimensions of the rails are laid down, as well as the tests which they are to pass, &c. Drawings of test pieces, and full-size sections of the rails, are appended to the report. The weights range from 60 to 100 lb. per yd. Messrs. Crosby Lockwood & Son are the publishers.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

22,832. "Apparatus or means for automatically operating and controlling electric motor starters, particularly when used in connection with pumps which require to be automatically started and stopped." THE TANGYE TOOL AND ELECTRIC CO., LTD., and A. H. BATE. October 24th.

22,838. "Improvements in or relating to electric arc lamps." THE JANDUS ARC LAMP AND ELECTRIC CO., LTD., and A. D. JONES. October 24th.

22,839. "Improved method of supporting electric tramway overhead power-transmitting or trolley wires." J. W. ALLEN. October 24th. (Complete.)

22,868. "Improvements in and relating to condensers." A. MICHELBACH. October 24th.

22,903. "Improvements in and relating to controllers for electric circuits." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co, United States.) October 24th.

22,904. "Improvements relating to electrical measuring instruments." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) October 24th.

22,905. "Improvements in electro-thermic fans." F. DE MARE. October 24th. (Complete.)

22,908. "Multiple connecting system for telegraphic and telephonic communication." O. ARENDT. (Date applied for under Patents Act, 1901, October 24th, 1903, being date of application in France.) October 24th. (Complete.)

22,914. "Improvements in switch lampholders for electrical purposes." H. ASHTON. October 25th.

22,915. "Improvements in the construction of single and two-way electric switches." C. B. F. OLAI and BROWN & BARLOW, LTD. October 25th.

22,920. "Improvements in insulated bolts for electric tramway systems and the like." J. HAYDOCK and T. S. JONES. October 25th.

22,935. "An improved combination reflector or parabola for automobile lamps burning or using either paraffin, electricity or acetylene as its illuminant." S. RUSSELL. October 25th.

22,944. "Mercurial, electrical and hydraulic automatic gas extinguisher in cases of fires by accident or otherwise, and of steam or water." J. P. PAVIS and W. H. EDWARDS. October 25th.

22,954. "Means of cooling, circulating or and producing ignition for motor and other engines." J. J. MULLER. October 25th.

22,959. "Improvements in electric incandescent candle lamps." A. W. PITT. October 25th.

22,962. "Improvements in connection with vacuum brake apparatus for electrically-operated and other trains." J. GRESHAM, H. E. GRESHAM and G. KIERMAN. October 25th.

22,964. "Improvements in gas or vapour electric apparatus." J. R. BAKER. October 25th. (Date applied for under Patents Act, 1901 November 6th, 1903, being date of application in United States.) (Complete.)

22,966. "Improvements in the construction of dynamo and like brushes." F. J. CHAPLIN and R. CHAPLIN. October 25th.

23,001. "Improvements in automatic electric switches." W. M. SCOTT. October 25th. (Complete.)

23,009. "Improvements in or relating to intercommunication telephone systems." I. B. BIRNBAUM and H. G. WHITE. October 25th. (Complete.)

23,027. "An improved terminal for resistance coils." J. A. HIRST and P. S. BROOK. October 26th.

23,031. "Improvements in fuse heads for electric blasting." F. RENDER. October 26th. (Complete.)

23,032. "Improvements in hangers or ears for electric trolley wires." L. T. ALLEN and R. E. SHARPLES. October 26th.

23,050. "Improvements connected with electrical railways." O. S. GILL. October 26th. (Complete.)

23,056. "Improvements in electrical switches, particularly applicable for use on motor-cycles and the like." C. W. HATHAWAY and TRIUMPH CYCLE CO., LTD. October 26th.

23,084. "Improvements in switches for reversing the current in electric motors." G. H. WHITTINGHAM. October 26th. (Date applied for under Patents Act, 1901, October 29th, 1903, being date of application in United States.) (Complete.)

23,090. "Improvement in methods of increasing the effective radiation of electro-magnetic waves." J. S. STONE. October 26th. (Date applied for under Patents Act, 1901, October 30th, 1903, being date of application in United States.) (Complete.)

23,093. "Improvements in contact breakers for overhead systems of electric traction." H. V. MITCHELL. October 26th.

23,095. "Thermo-electric generators." F. W. HOWORTH. (W. E. Haskell, United States.) October 26th. (Complete.)

23,097. "Improvements in electrical measuring instruments." G. C. FRICKER. October 26th.

23,109. "Improvements in and connected with electro-capillary apparatus." J. T. ARMSTRONG and A. OBLING. October 26th.

23,118. "Electro-magnetic device for automatically applying sanding apparatus on electrically driven vehicles." M. CUMMINS. October 27th.

23,128. "Improvements relating to the trolley pulleys of electric tramcars and the like." B. R. THOMPSON. October 27th.

23,150. "Improvements in apparatus for the distribution of alternating electric current." A. F. BERRY. (Date applied for under Patents Act, 1901, October 29th, 1903, being date of application in France.) October 27th. (Complete.)

23,182. "Improvements in electric fire alarms." W. B. HOPKINSON. (Date applied for under Patents Act, 1901, April 15th, 1904, being date of application in United States.) October 27th. (Complete.)

23,201. "Improvements in or connected with the third rail insulators of electrical railways." E. J. CHAMBERS. October 27th.

23,203. "Improvements in contacts for electric controllers, reversing switches, and the like." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) October 27th.

23,204. "Improvements in electric heating apparatus." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co, United States.) October 27th.

23,205. "Improvements in and relating to the regulation of alternating electric distributing systems." THE BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts Gesellschaft, Germany.) October 27th.

23,219. "Improvements in the caps of electric lamps, adapters, and similar fittings." H. ASHTON. October 28th.

23,222. "Improvements in electric stop motions for drawing and roving frames." W. MUIR, G. W. SOMERVILLE and HOWARD & BULLOUGH, LTD. October 28th.

23,253. "An improved construction of section insulator for electric trolley wires or the like." T. E. R. PHILLIPS. October 28th.

23,254. "An improved construction of trolley head for collecting electricity from electric trolley wires or the like." T. E. R. PHILLIPS. October 28th.

23,271. "Improvements in and relating to the manufacture of insulators of glass and the like." LA SOCIETE BERGER, LORD ET CIE. (Date applied for under Patents Act, 1901, November 6th, 1903, being date of application in France.) October 28th. (Complete.)

23,276. "Improvements in electrical apparatus and method of manufacturing and operating the same." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) October 28th.

23,279. "Improvements in electrical resistances." H. ARON. October 28th. (Complete.)

23,302. "Improvements in, or connected with, magnetic or electro-magnetic mechanism." L. H. WALTER. October 29th.

23,352. "Improvements in, and relating to, carbons for electric arc lamps and the like." O. HELLSTERN. October 29th.

23,377. "Improvements in dynamos." I. DEUTSCH. October 29th. (Complete.)

23,392. "Improvements in alternating current motors, also relating to generators and direct current machines." V. A. FYNN. October 29th.

PATENTS EXPIRING DURING 1904.

(*Continued from page 763.*)

11,083. "Improvements in engine governing arrangements." C. A. PARSONS. July 16th, 1890. Relates to a governor of the class in which a pump of any suitable description is worked from some moving part of the engine or a counter-shaft, or by an electrometer or other means, and either forces air into or withdraws air from a reservoir in which works a piston connected with the controlling-valve of the engine. From or into this reservoir air is allowed to flow through a regulable device at such rate as either to keep the controlling-valve permanently open, in which case it acts somewhat like a throttle valve, or to allow the controlling-valve to close completely at each stroke of the air-pump, in which case it performs the function of an admission and cut-off valve. The former arrangement is more especially applicable for governing steam turbines.

12,221. "An improved apparatus for the measurement of electrical energy." H. H. LAKE. (E. Weston.) August 5th, 1890. Relates to meters of the electro-dynamometer type for measuring the electromotive force or strength of alternating currents. For measuring electromotive force, two fine wire coils are arranged in series with a resistance coil. One coil is wound on two fixed bobbins which can be removed from the framework by removing screws. The second coil is wound on a frame carrying pivots working in adjustable bearings to permit of the rotation of the frame in opposition to two springs; the upper pivot carries an indicator, and the frame is fitted with a mica disk which, in conjunction with a fixed diaphragm, forms a damping device. For measuring current strength, the fixed coil is made of low resistance, and the two conductors are arranged in multiple arc.

13,123. "Improvements in electricity meters for alternating or interrupted currents." G. HOOKHAM. August 21st, 1890. Motor meters for alternating or intermittent currents. A metallic disk, preferably of aluminium, is mounted on a spindle so as to rotate between the poles of an electro-magnet excited by a coil connected across the mains, or a shunt on the mains. The current to be measured, or a current proportional to it, circulates through four flat vertical coils, fixed so that a part of each lies between the disk and a pole of the magnet. The current may be divided so that one part circulates through the two upper coils, and the other part through the two lower coils. In a modification, a movable screen or mass of iron is arranged between the disk and a pole of the magnet. The position of the screen is regulated by a solenoid, through which the current to be measured passes. The magnet is excited by a coil in series or in shunt with the current to be measured. Instead of a movable mass of iron, a fixed mass, the magnetic state of which is varied by the current, may be employed. The disk, or a second disk on the same spindle, is embraced by a permanent steel magnet, which acts as a brake, as described in Specification Nos. 4,225 and 17,502, A.D. 1887. The spindle is in gear with the ordinary counting mechanism. In the provisional specification there is also described a bobbin-shaped armature. The edges of the disks forming the sides of the bobbin dip into mercury, and one pole of a laminated bar magnet is inserted between the immersed parts.

13,260. "Improved means for the distribution of electricity." M. VON DOLIVO-DOBROWOLSKY and P. MAMROTH. August 22nd, 1890. Relates to systems of distribution with a series of alternating currents differing in phase, the difference being proportional to the number of currents, and to regulators therefor.

13,356. "Improvements in the manufacture of sodium and potassium." H. Y. CASTNER. August 25th, 1890. Asbestos or other suitable insulating-packing is used. The electrolyte is heated by gas jets. The process is conducted at a temperature about 30° C., above the melting-point of the caustic alkali, any water present having been first decomposed by electrolysis at atmospheric temperature.

14,077. "An automatic transmitter for submarine cables or long telegraph lines." T. J. WILMOT. September 8th, 1890. Relates to an automatic telegraph transmitter for submarine or long telegraph lines.

15,786. "Improvements in semaphore signalling apparatus for use on board ship, at coastguard stations, and the like." L. B. STEVENS. October 6th, 1890. Relates to semaphore signals for use on board ship, at coastguard stations, and the like. The signal post consists of vertical bars connected by open lattice-work, and fixed to a trunk which is fitted to rotate on a pillar carried by a foundation fixing. The signalling apparatus may be rotated about the pillar by means of a lever which can be moved into an horizontal position. When the post is long, it is stayed by means of guy ropes connected to a ring fitted with inclined rollers which travel on a plate. The base, or foundation, may be secured by bolts, &c., and in concrete, &c.

16,060. "An improved method of obtaining metallic sodium." L. GRABAU. September 22nd, 1890. Metallic sodium is produced by electrolysing a mixture of sodium and potassium chlorides with chlorides of the alkaline earths.

16,852. "Improvements in treads for floors, stairs, and the like." J. MASON, J. MASON and W. S. CODNER. October 22nd, 1890. These treads may be applied to telegraph wire boxes in streets, and the like. Strips of chilled or hardened metal are provided with studs of lead, rubber or the like to prevent slipping. Interlocking lead or other strips may also be arranged alternately with the strips. The studs are secured with contracted apertures of the strips by expanding the material on each side.

17,560. "Improvements in and relating to locked switches for electric current circuits." J. A. ILIFFE and H. BARTON. November 1st, 1890. Relates to switches such as are described in Specifications No. 6,247, A.D. 1887, and No. 14,825, A.D. 1888. The fixed contacts are formed with cylindrical faces, against which the ends of the brush, formed of spring plates, work. The contacts can be moved to compensate for wear by means of screws. They slide on plates which are fixed to the base. The switch is locked by a spring catching in a tooth carried by a plate fixed to a brush. The locking-bar is carried on a plate which is firmly secured to the handle. The handle is removably attached to the central spindle by a screw. It may thus be taken away to prevent tampering with the switch. The terminals are passed through holes in the base and fixed plates, and secured by nuts.

18,294. "Improvements in switches for electrical purposes." B. M. DRAKE and J. M. GORHAM. November 13th, 1890. The circuit is completed through a U-shaped bar pivoted on a bolt, the free ends of the bar pressing against fixed contacts. The pressure between the contacts is regulated by a screw. A spring tends to break the circuit, but is prevented by the frictional contact. The bar which may be in one piece, or built up of thin plates, is moved by a handle.